Hodoscope Recalibration and More PbGl Analysis

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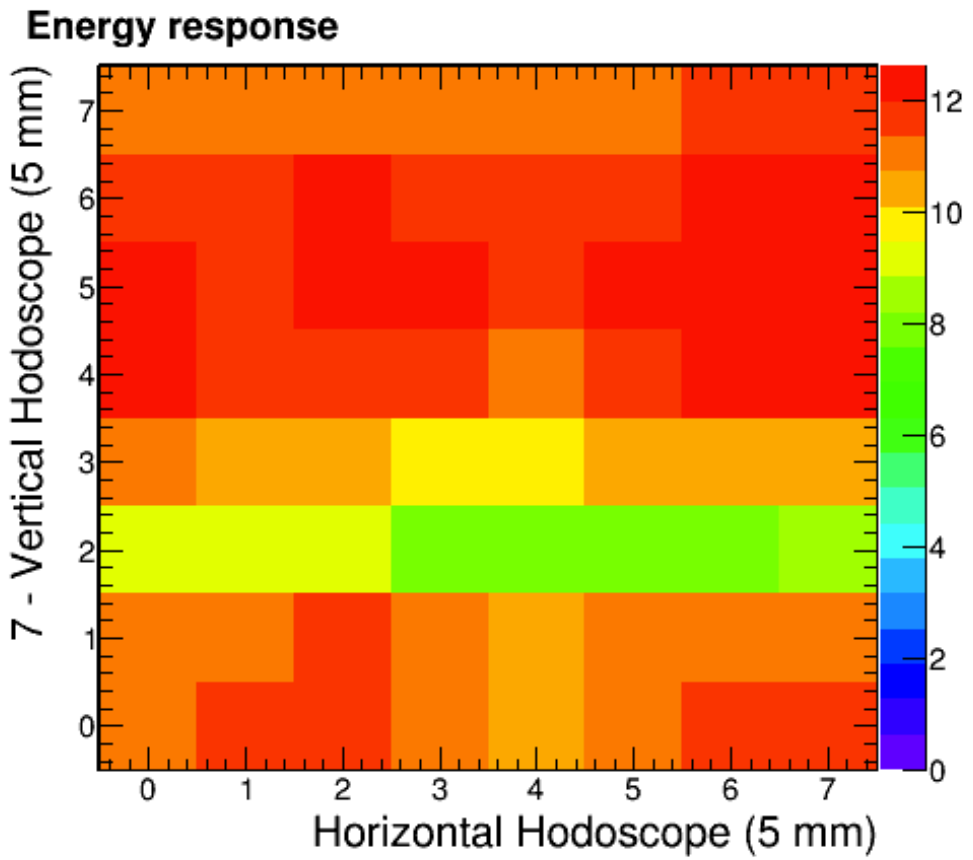
Overview

- Working with Jin on EMCal linearity and resolution plots
- Added new linearity and resolution plots for the first/second joint EMCal and HCal energy scans to the wiki
- Jin tasked me with making a hodoscope recalibration, i.e. recalibrating measured energies due to hodoscope response
- Today
  - Hodoscope recalibration method
  - Some results
  - Rechecking the PbGl resolution

Hodoscope Recal Method



- ShowerCalib module shows that energy response is clearly a function of horizontal and vertical hodoscope position
- Procedure:
  - Make 5x5 recalibrated energy sum plot for each 8x8 hodoscope bin for 8 GeV data
  - Energy scale correction is then E_{beam}/E_{peak} from Gauss fit
  - Apply this correction to the (already) shower calibrated cluster energies

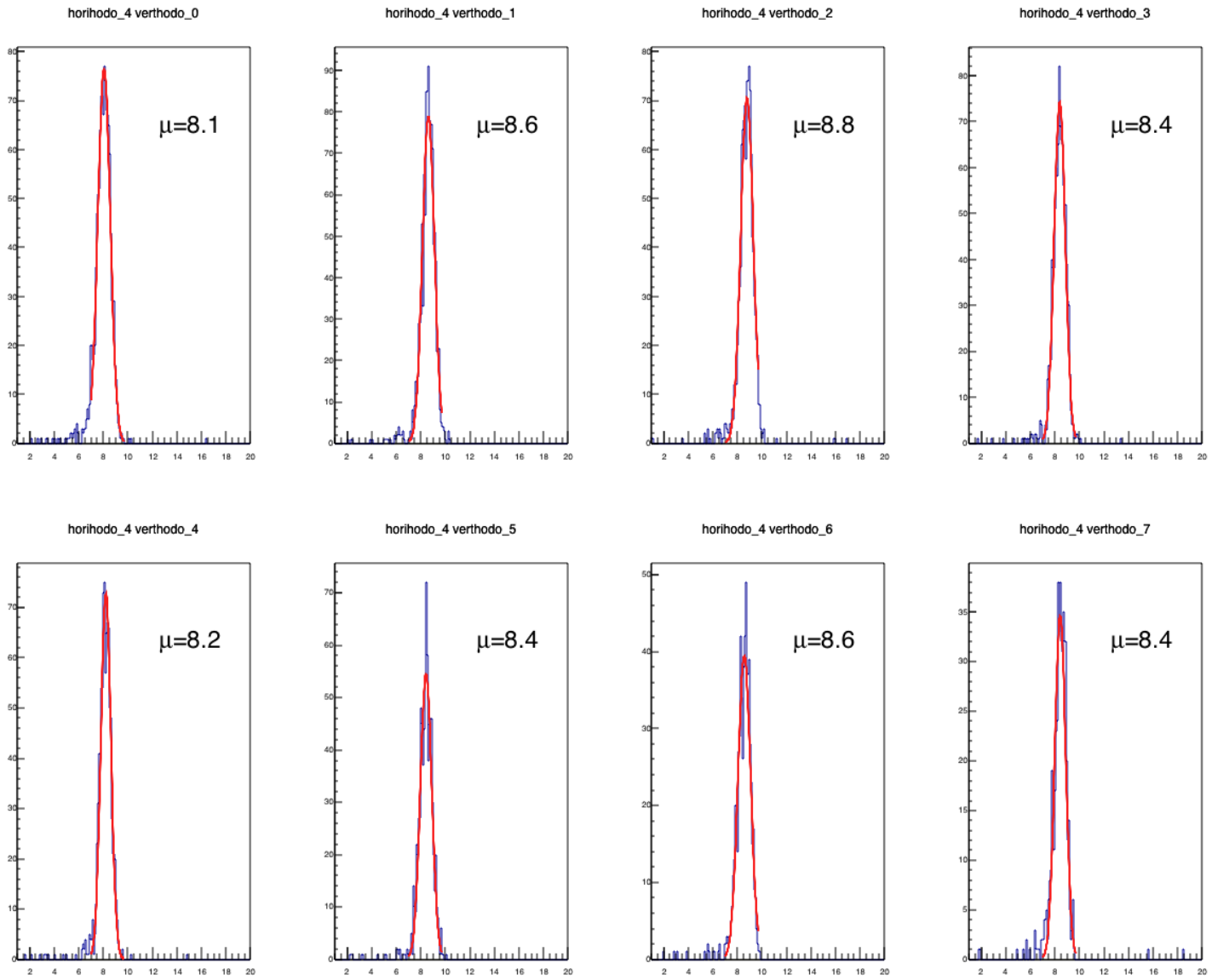
Hodoscope Recalibration

First joint energy scan (runs 3736-3741)

Modified ShowerCalib Module

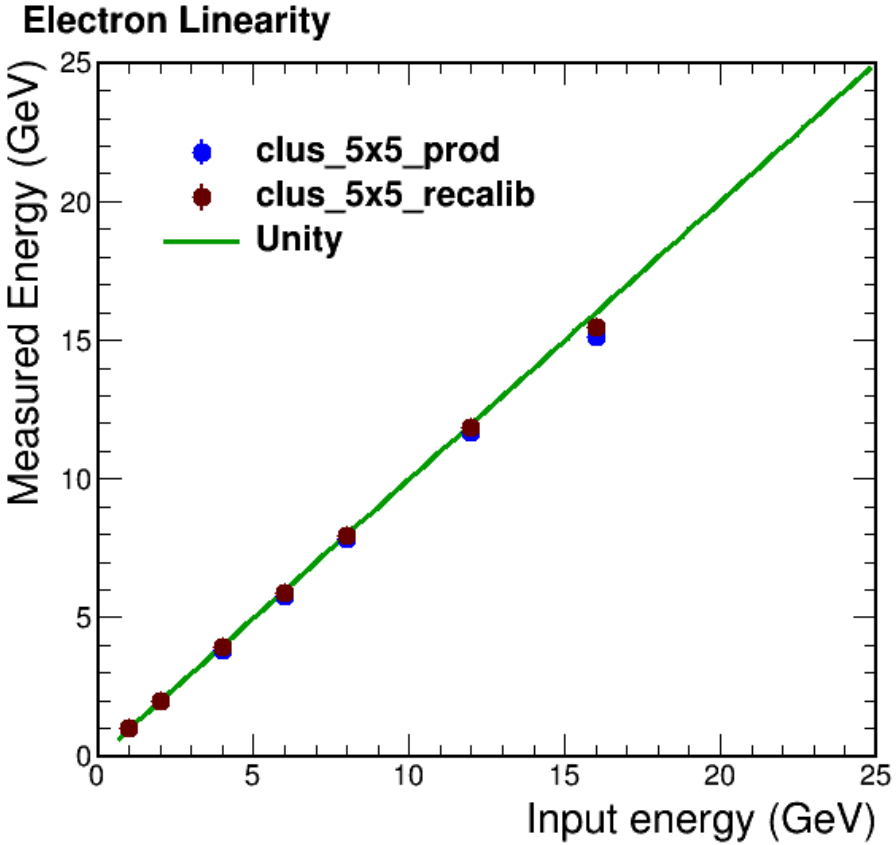
- I modified Jin's ShowerCalib module to include the hodoscope recalibration values
  - From old production (2/3/17): $E_{recal} = E_{tower} \times C^{Jin}_{shower\_calib} \times C^{Joe}_{hodoscope\_calib}$
  - For new production (2/17/17) which includes Jin's shower calibration already: $E_{recal} = E_{tower} \times C^{Joe}_{hodoscope\_calib}$
  - Analyzed runs 3736-3741
    - Joint HCal/EMCal scan tower 21

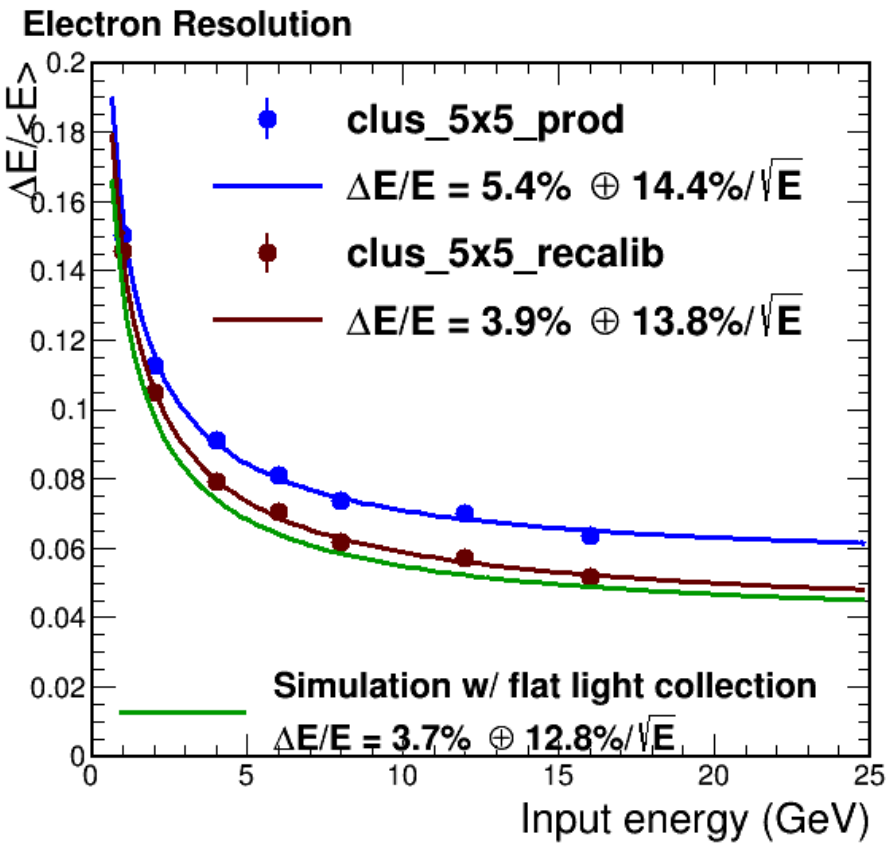
Example Hodoscope Fits



- This example shows energy response for horizontal hodoscope 4, and all vertical hodoscopes
- All hodoscopes in backups
- Fit to Gaussian and extract mean
- Correction is 8/μ for each hodoscope

EMCal Energy Resolution with Added Hodo Recalibration





- Resolution most impacted with 5x5 hodoscope cut (shown above)
- Smaller hodo cuts basically show no difference between the uncalibrated and calibrated energies (see backups)
- This is unsurprising as the smaller hodoscope cuts were implicitly selecting the areas that responded well already

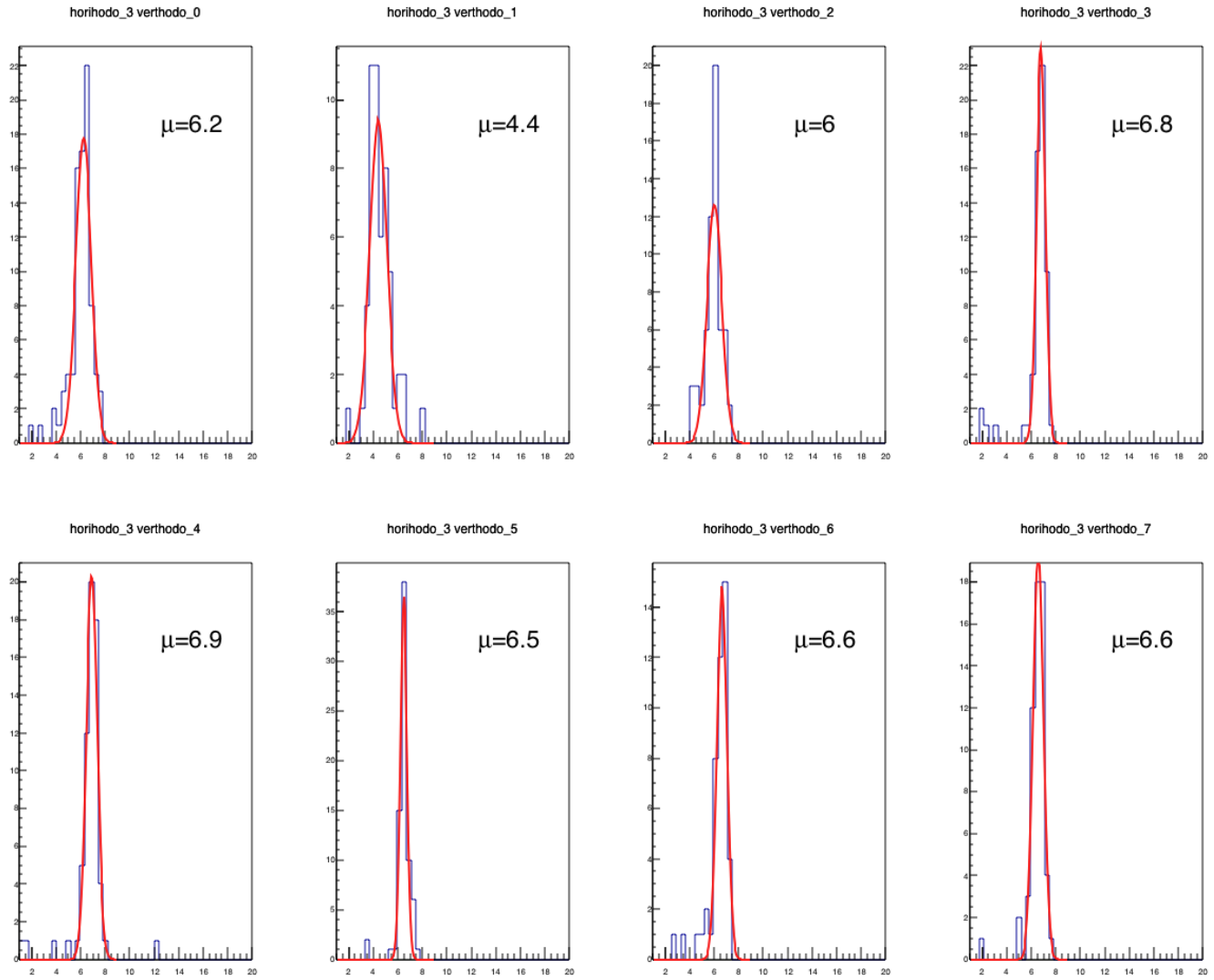
Hodoscope Recalibration

Third joint energy scan (runs 3997-4002)

Joint Energy Scan 3

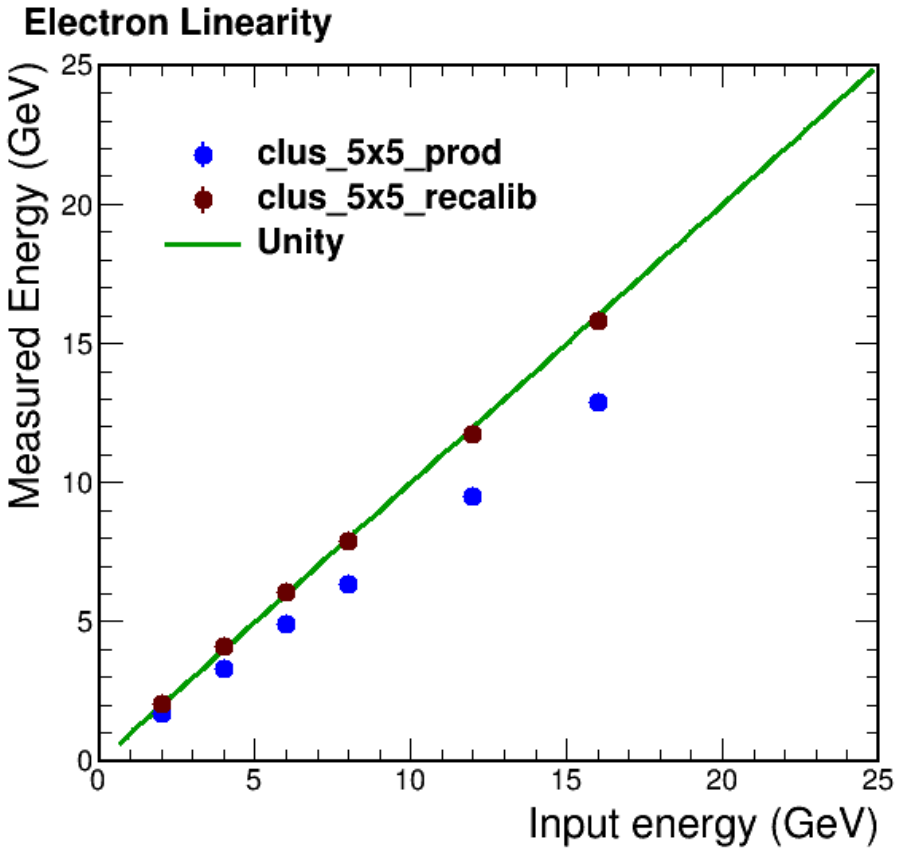
- This weekend a joint energy scan was taken with EMCal tower 21 including two block boundaries
- Will give us some idea of the resolution/linearity degradation when block boundaries are taken into consideration
- Took a quick look at the data for doing the hodoscope recalibration in the future
- Additionally made hodoscope recalibration for this set of runs too. Followed same method as for first joint runs
- Using run numbers 3997-4002, i.e. with EMCal bias at nominal level

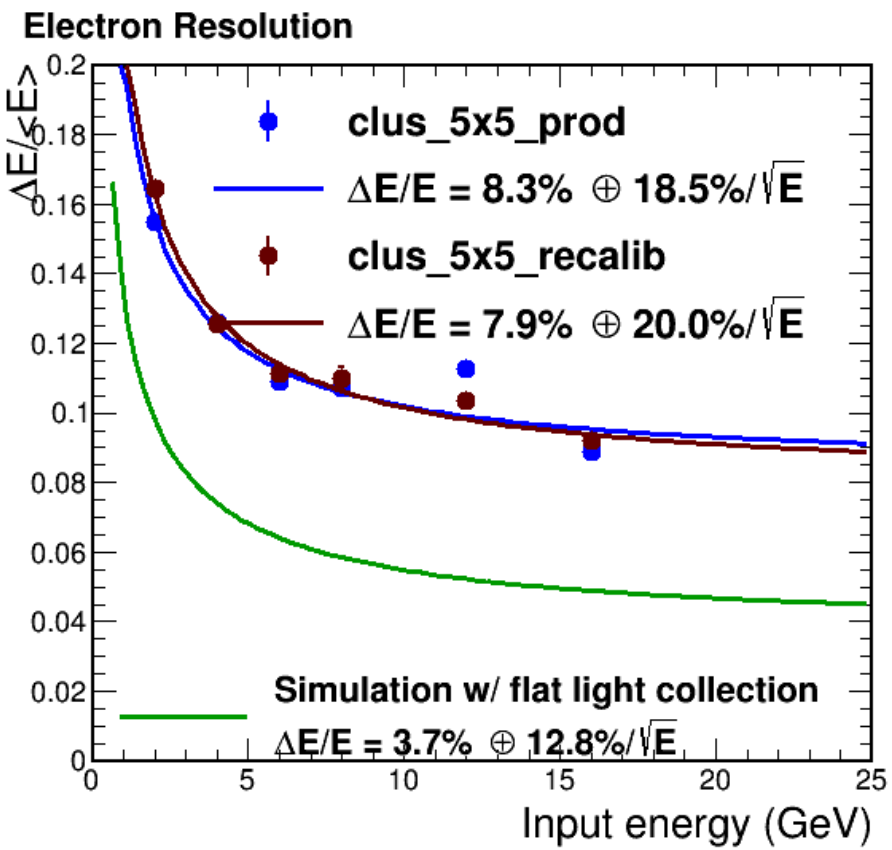
Example Hodoscope Fits



- Significantly worse response
- Note that the means are scattered around ~6.5, i.e. 1.5 GeV away from the nominal beam energy
  - For comparison the response from the first joint run was ~0.4 GeV

Energy Response

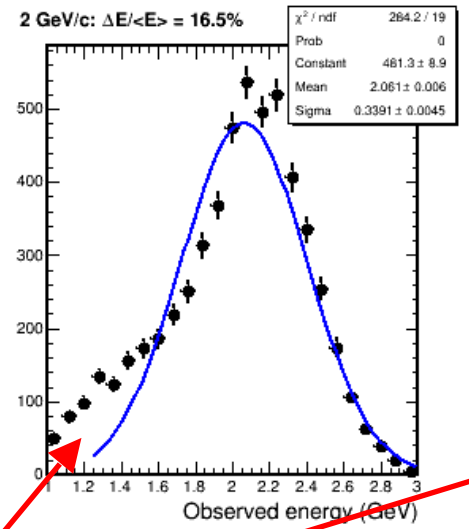


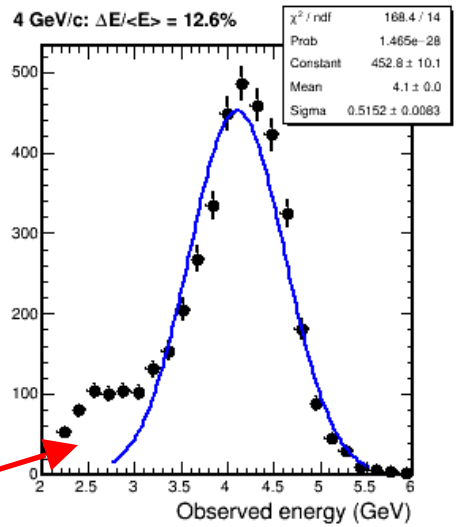


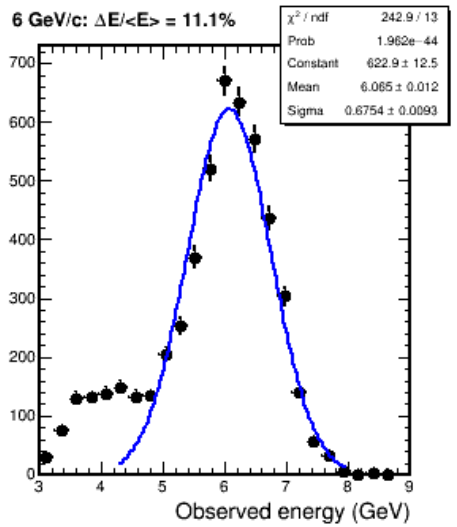
- Energy linearity greatly improved with recalibration
- Resolution looks basically the same. Why?

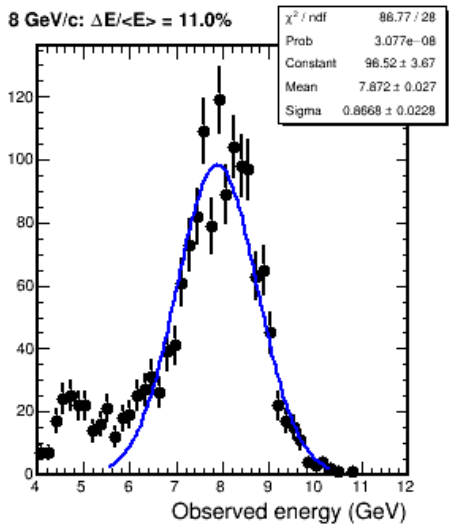
Energy Response

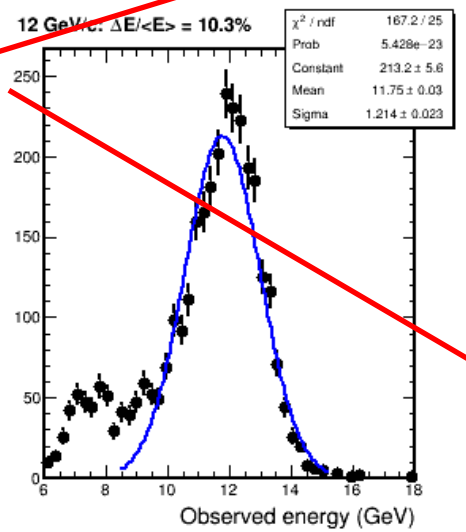
- Resolution might be a little better if fits are better constrained to a particular region
- Unsurprising: large background that is still present
- Will need to work more with cuts

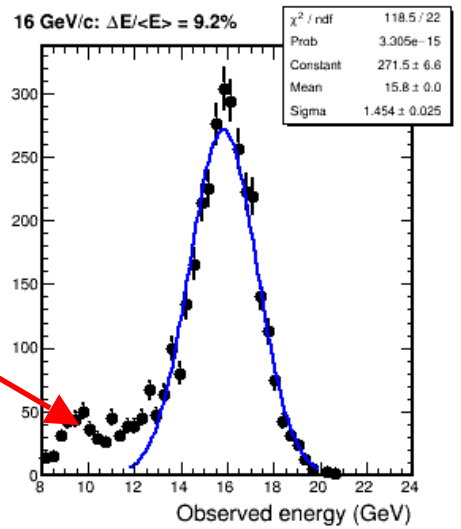










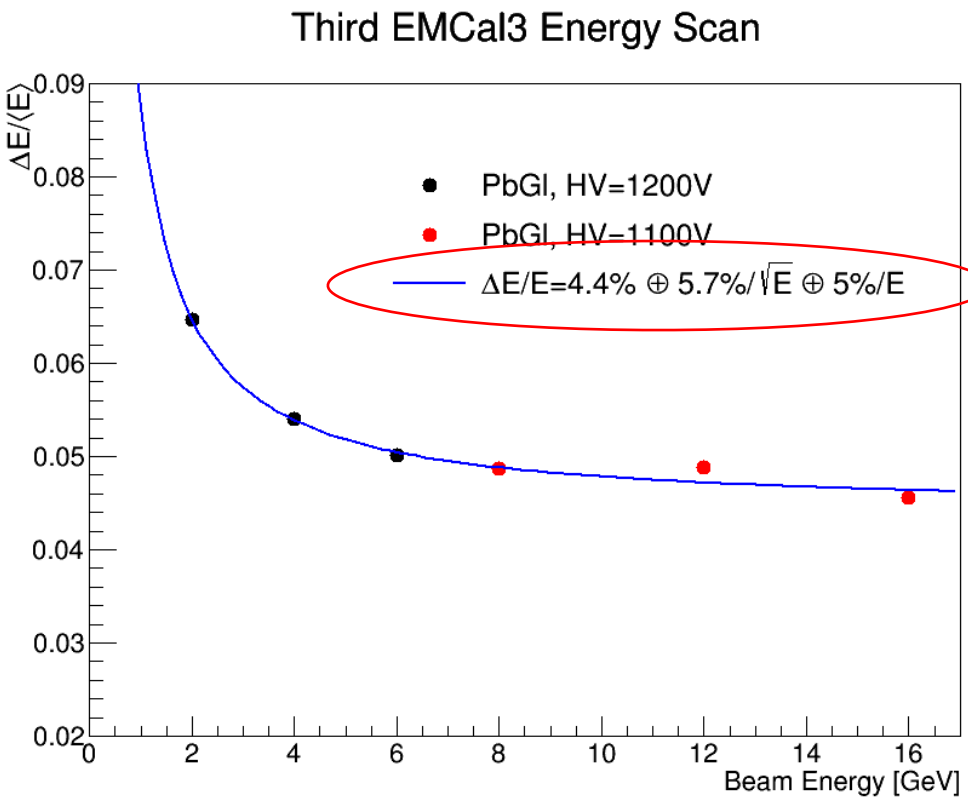


PbGl Resolution

PbGl Resolution

- Reminder – last week showed that PbGl resolution in third EMCal energy scan was not very good
  - Gains were turned down on PbGl resulting in effect
- PbGl runs taken in front of HCals recently
- Analyzed runs 3860-3874, info on wiki
- Cuts: C1 energy>100, vertical and horizontal hodoscope energy >3, PbGL time<12

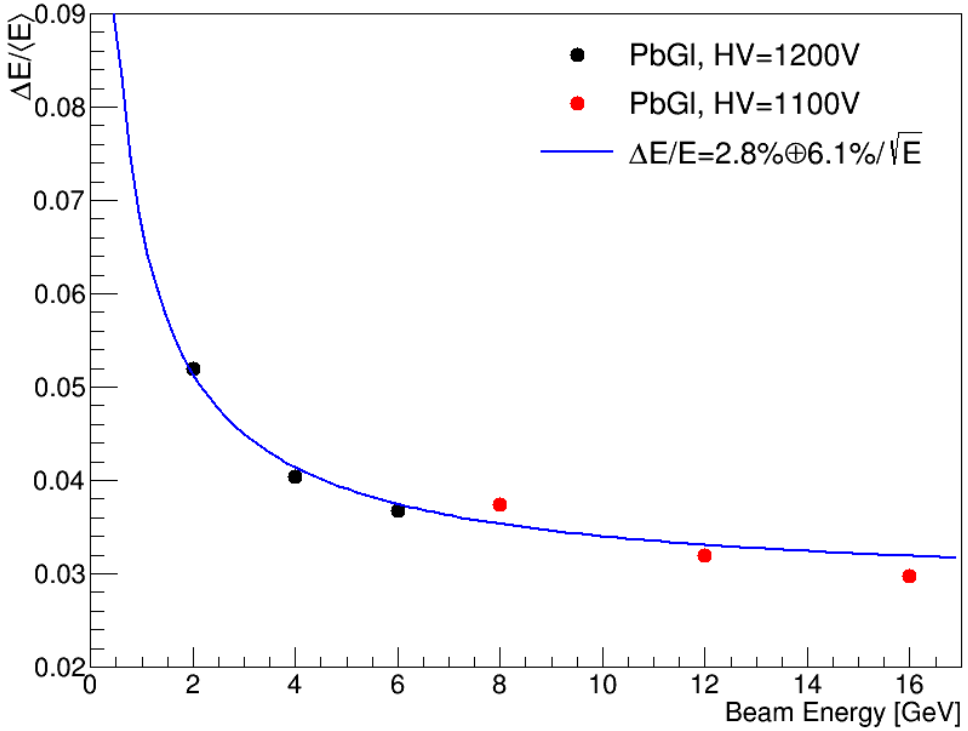
Last Week



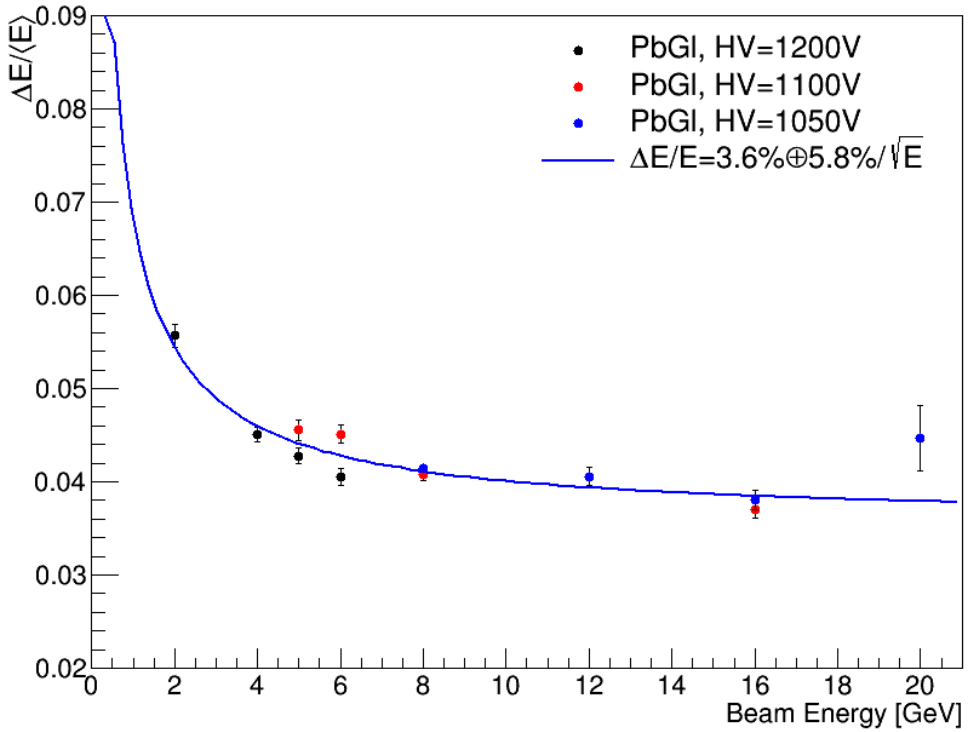
Bad

PbGl from Runs 3860-3874 (new)

Dedicated PbGl Runs (3307-3332)



With HCal (3860-3874)



- 1/sqrt(E) term is comparable to dedicated PbGl scan (left) but constant term is still larger
- Overall better than the third EMCal energy scan (from previous page)

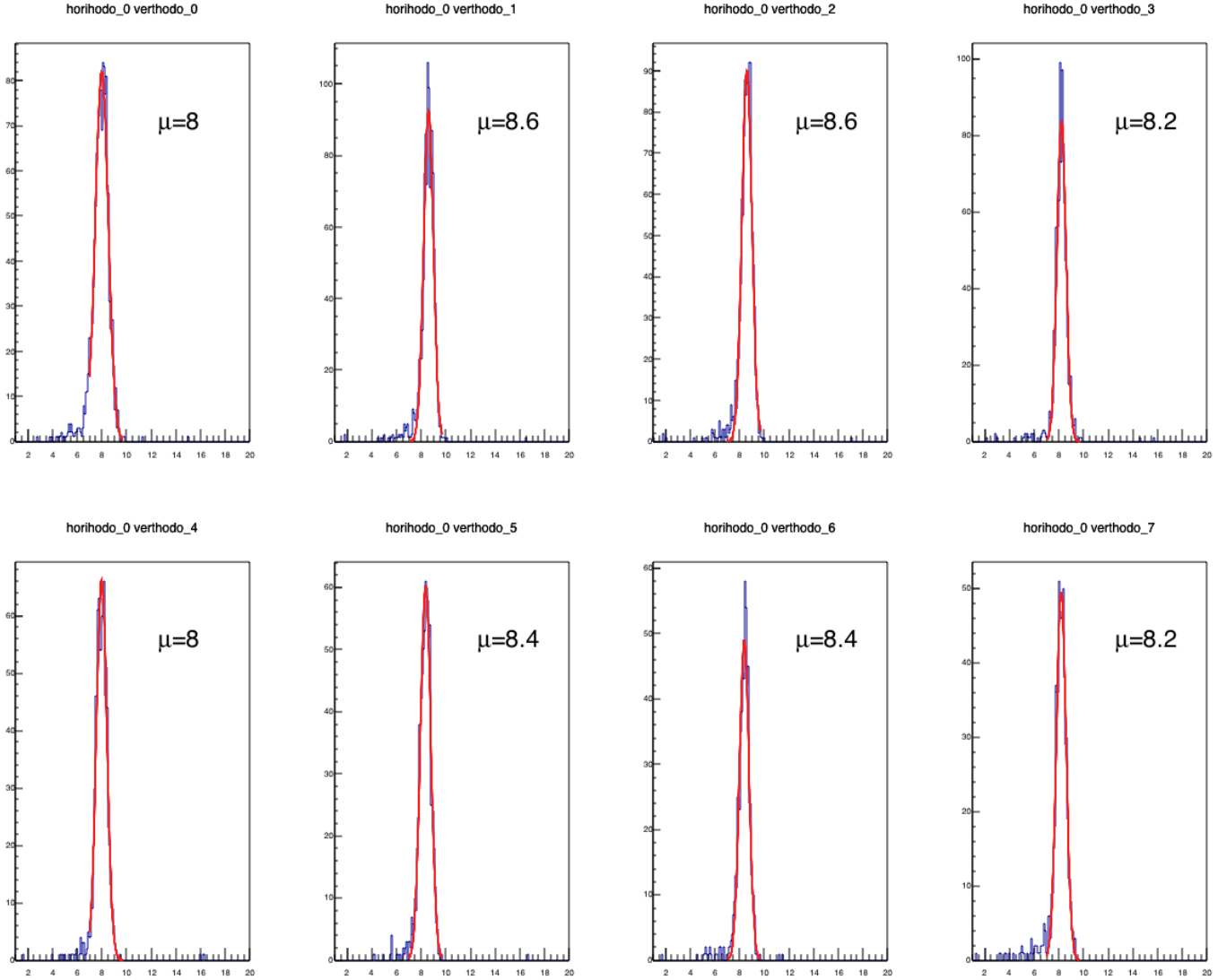
Summary

- Made hodoscope recalibration values for correcting measured energies for first joint energy scan
- Analyzed new energy scan PbGl runs
- To-Do
  - In principle this recalibration could go into next production (if others are satisfied with it)
  - Working on hodoscope recalibration for third joint energy scan which includes 2 block boundaries

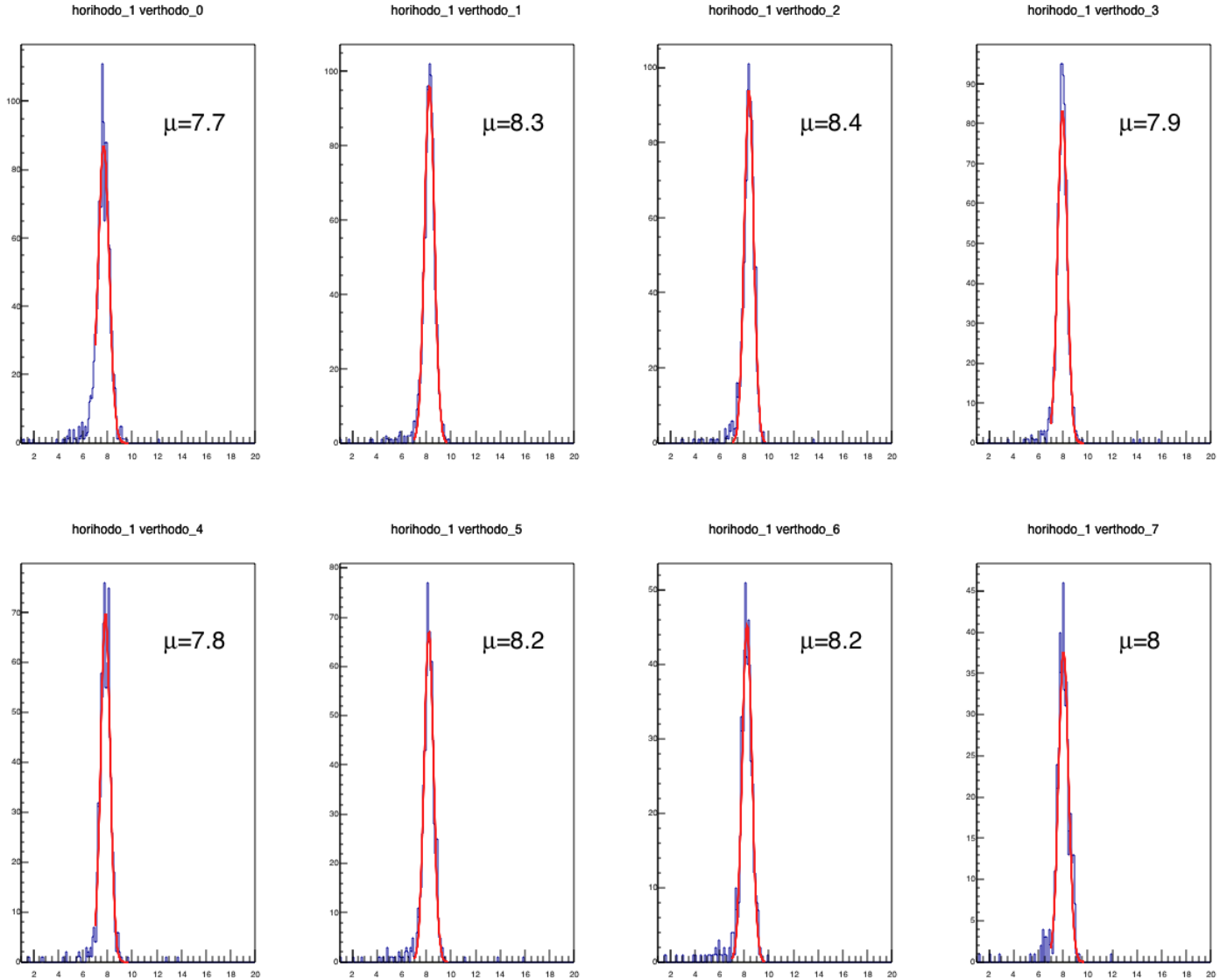
Back Ups

Hodo Recal (first joint energy scan)

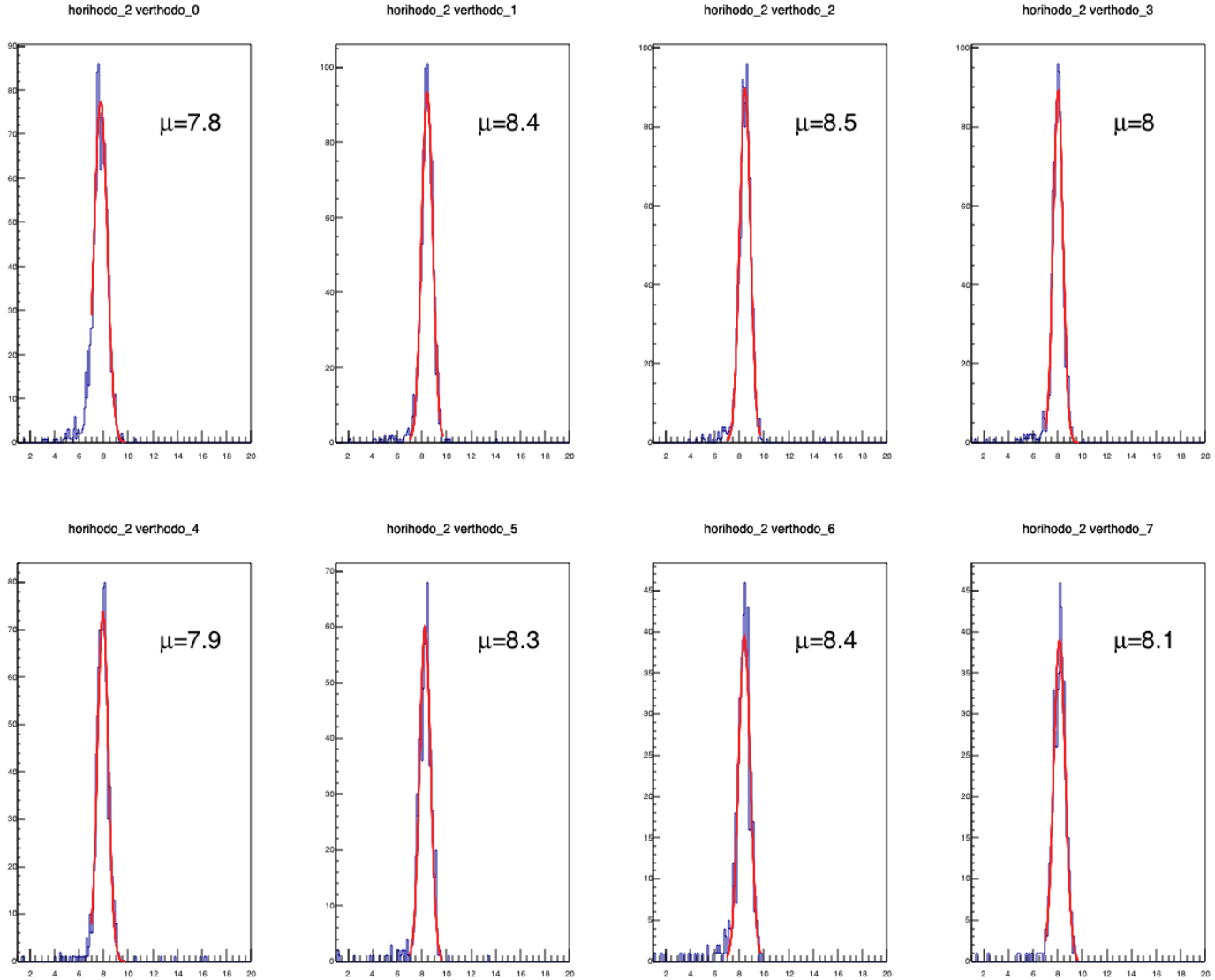
Horizontal Hodoscope 0



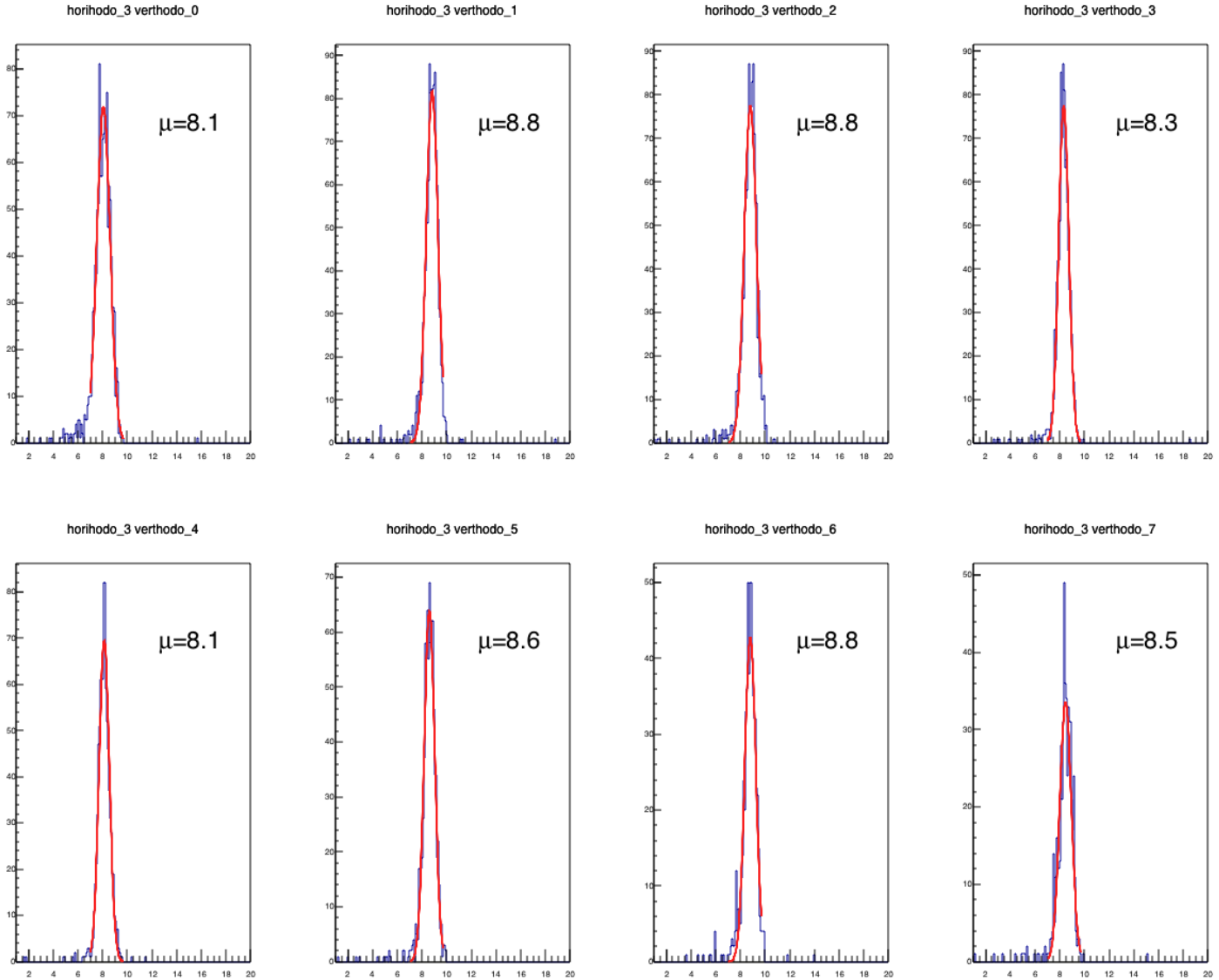
Horizontal Hodoscope 1



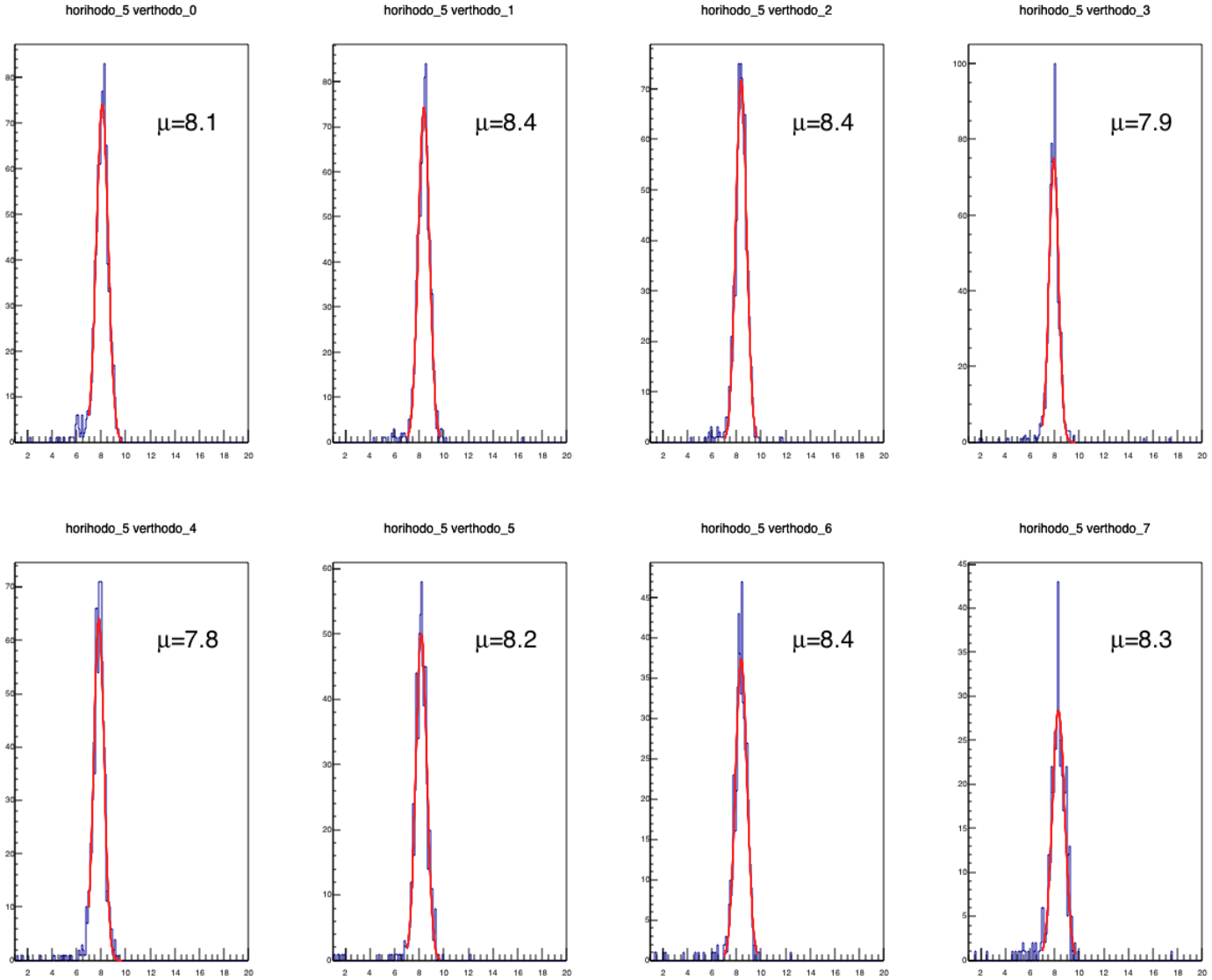
Horizontal Hodoscope 2



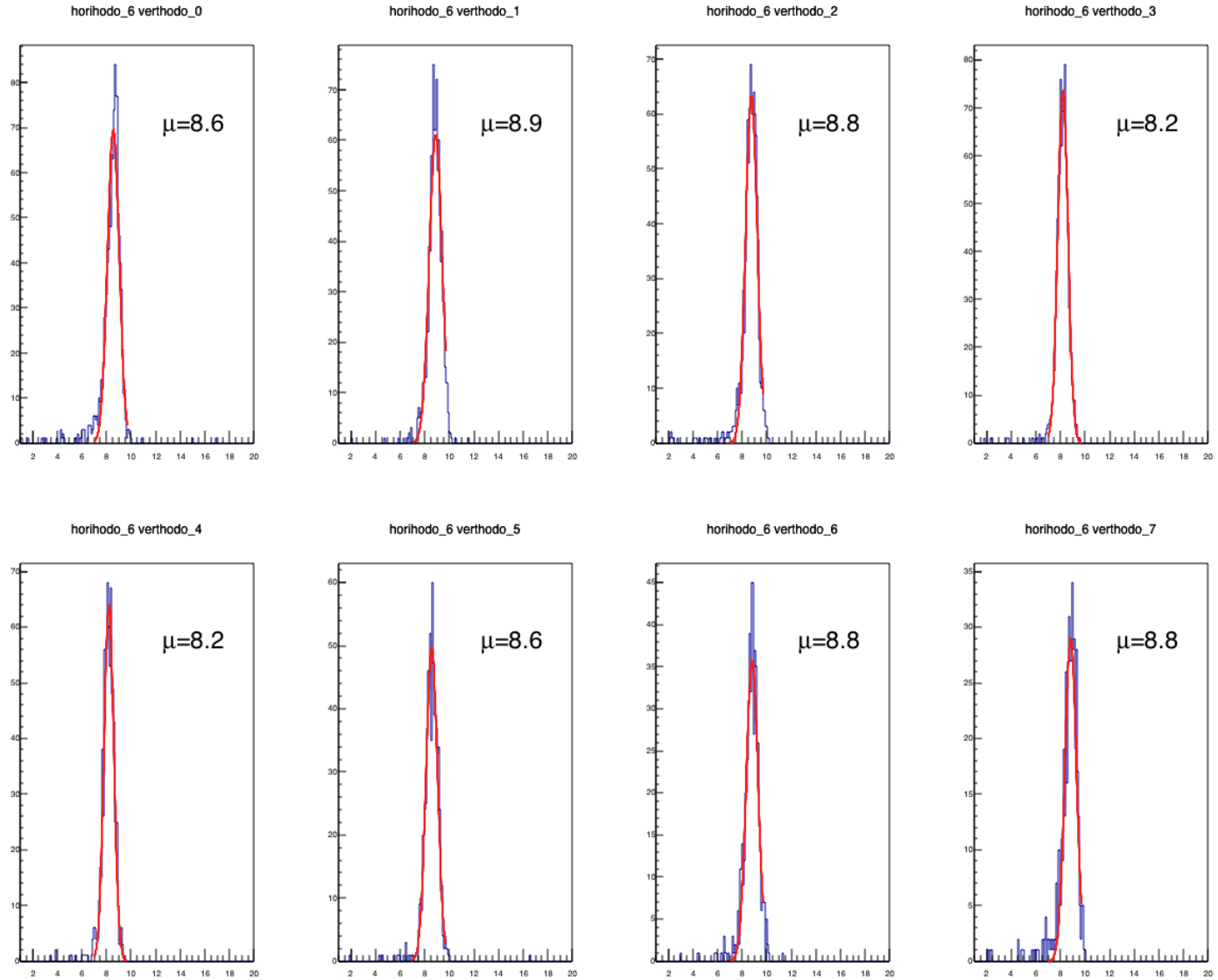
Horizontal Hodoscope 3



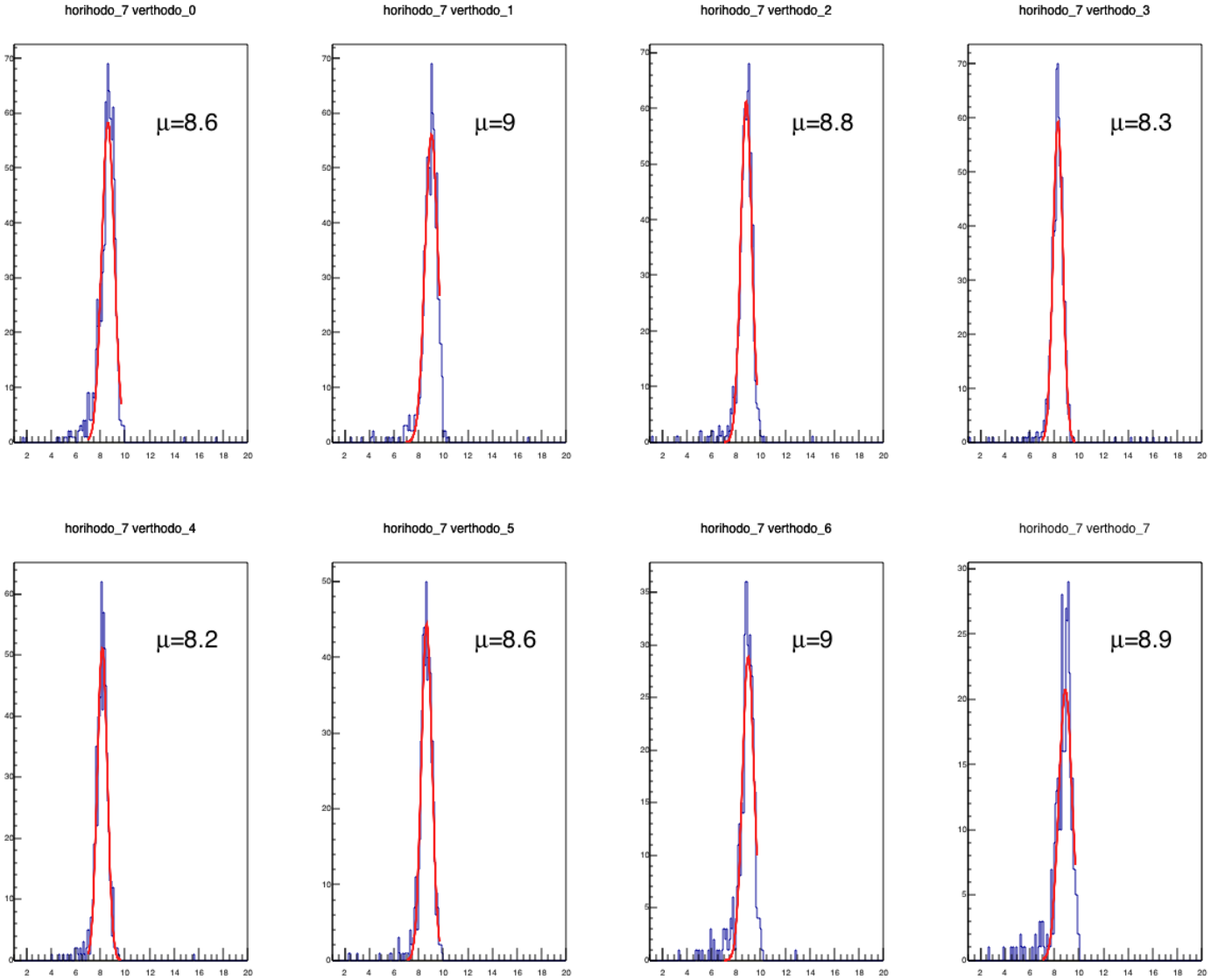
Horizontal Hodoscope 5



Horizontal Hodoscope 6

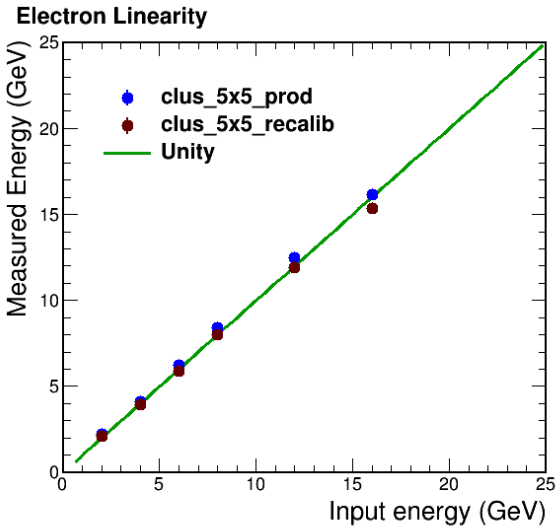


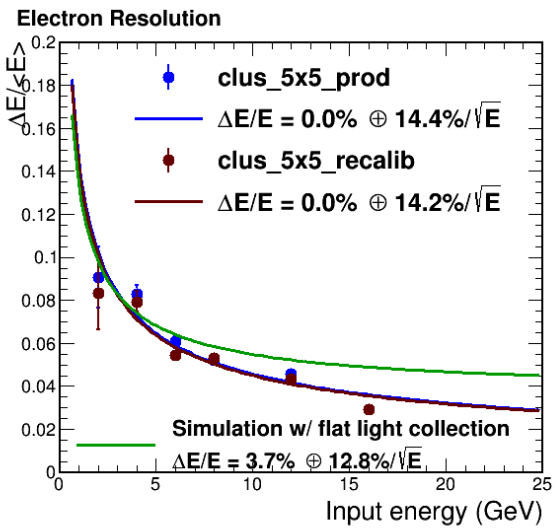
Horizontal Hodoscope 7



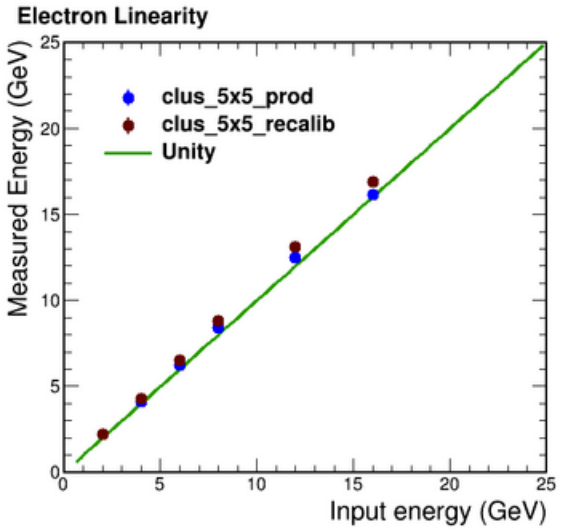
1x1 Hodoscope Cut (runs 3736-3741)

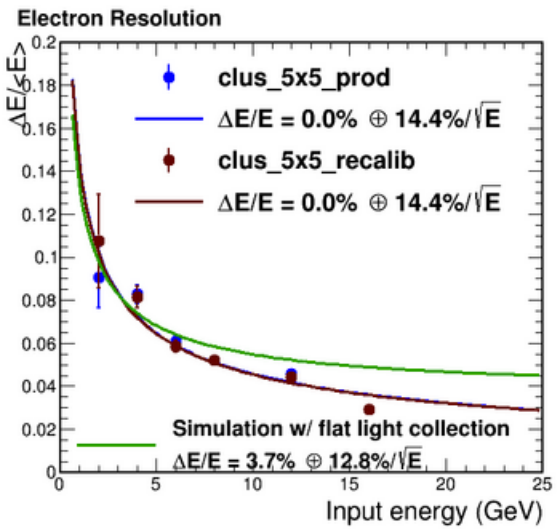
With Hodo Recal





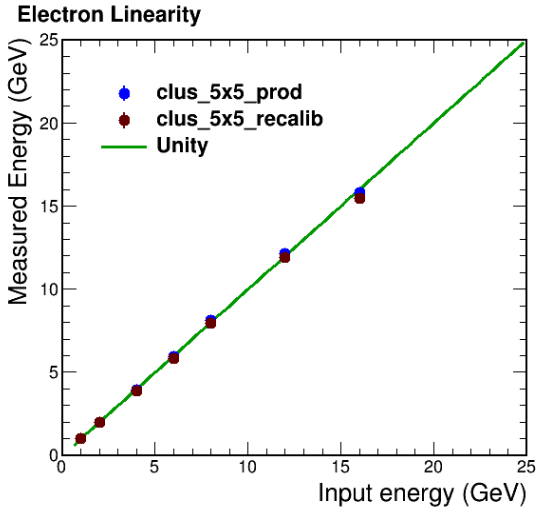
Without Hodo Recal

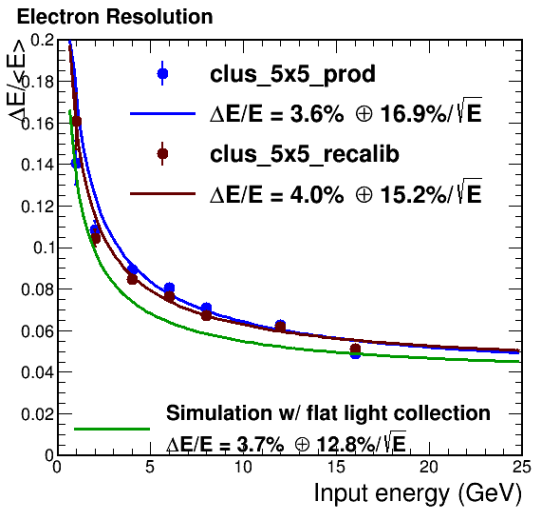




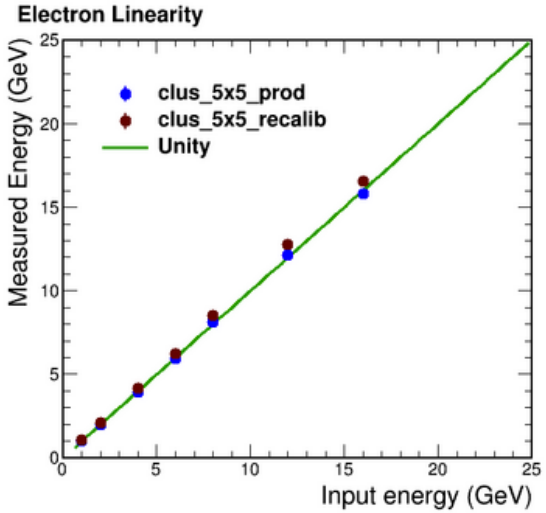
2x3 Hodoscope Cut (runs 3736-3741)

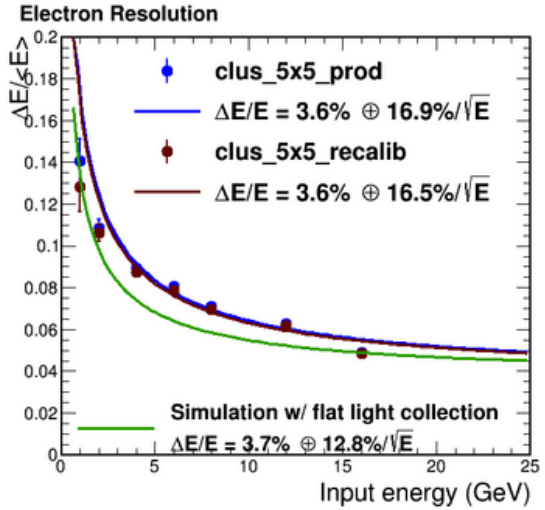
With Hodo Recal





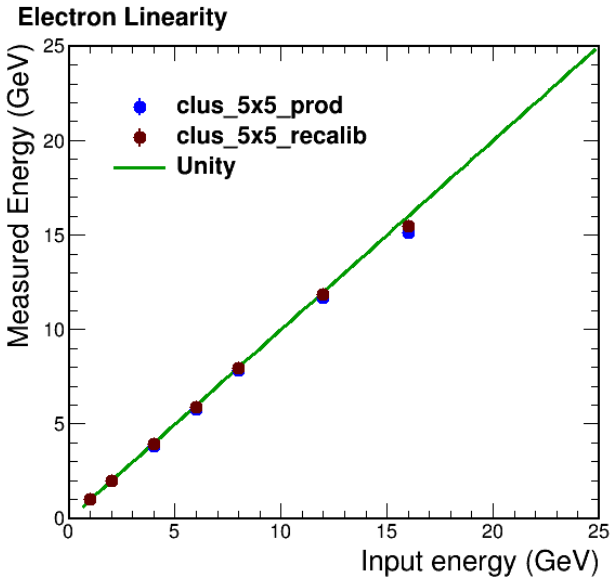
Without Hodo Recal

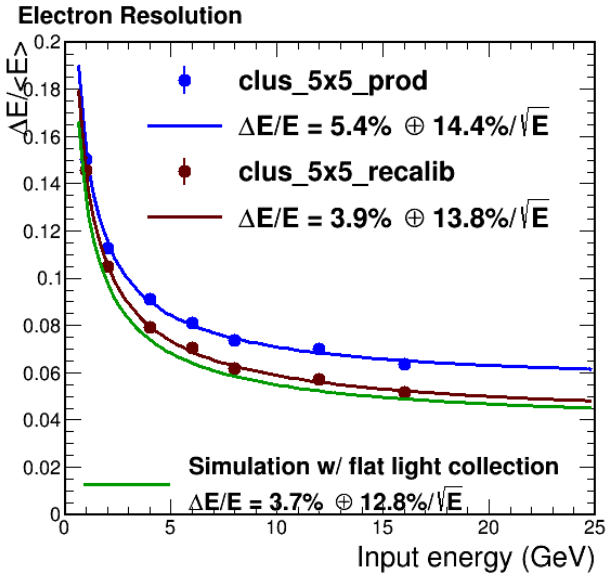




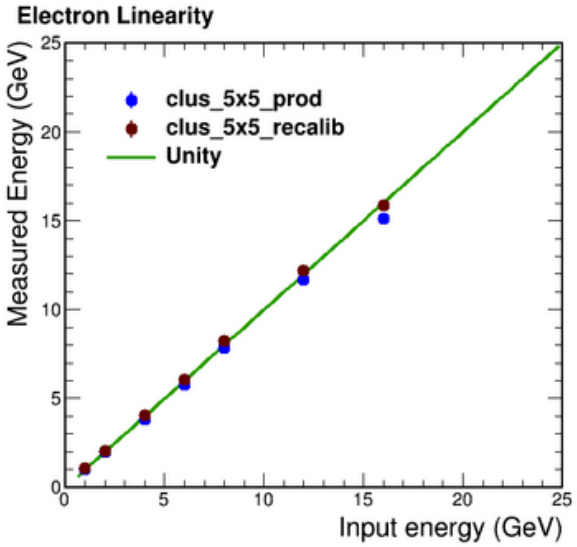
5x5 Hodoscope Cut (runs 3736-3741)

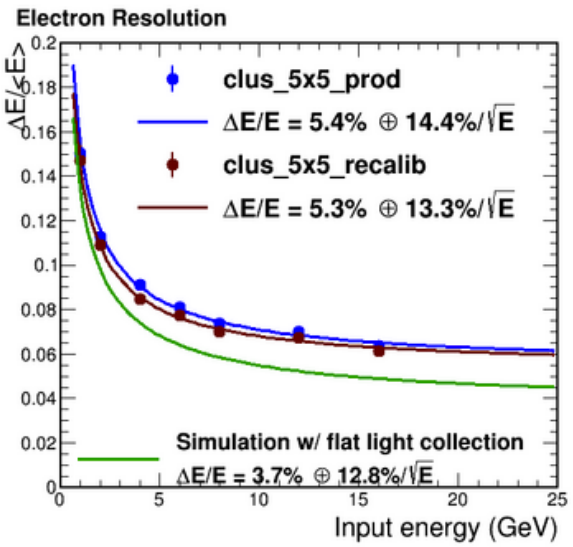
With Hodo Recal



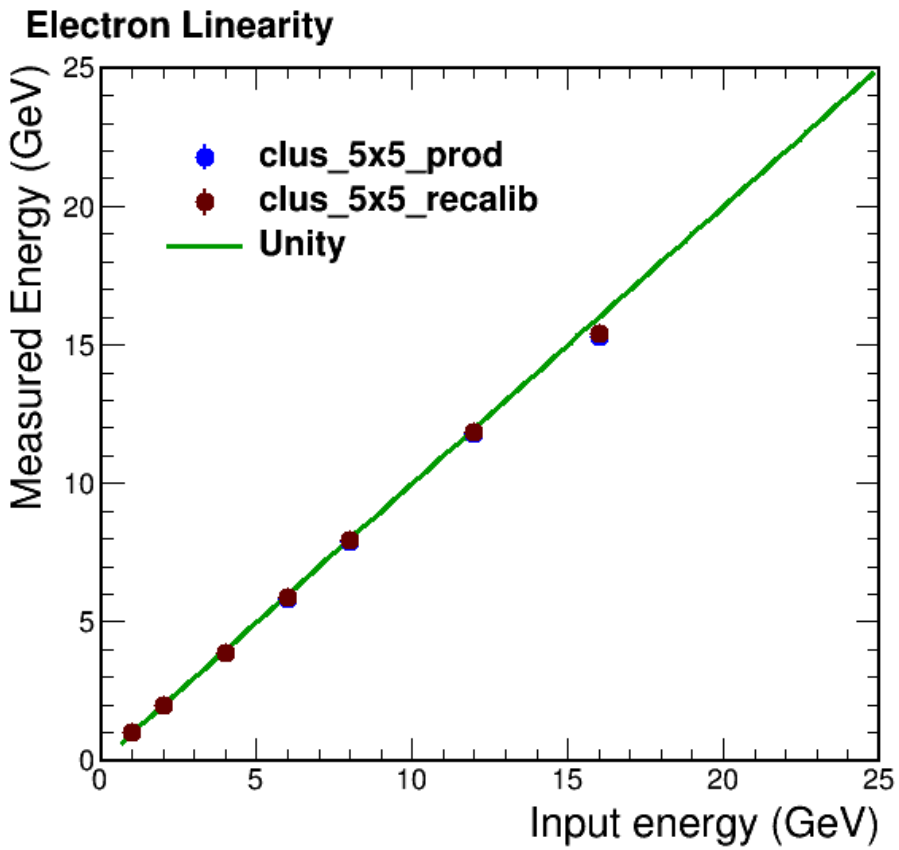


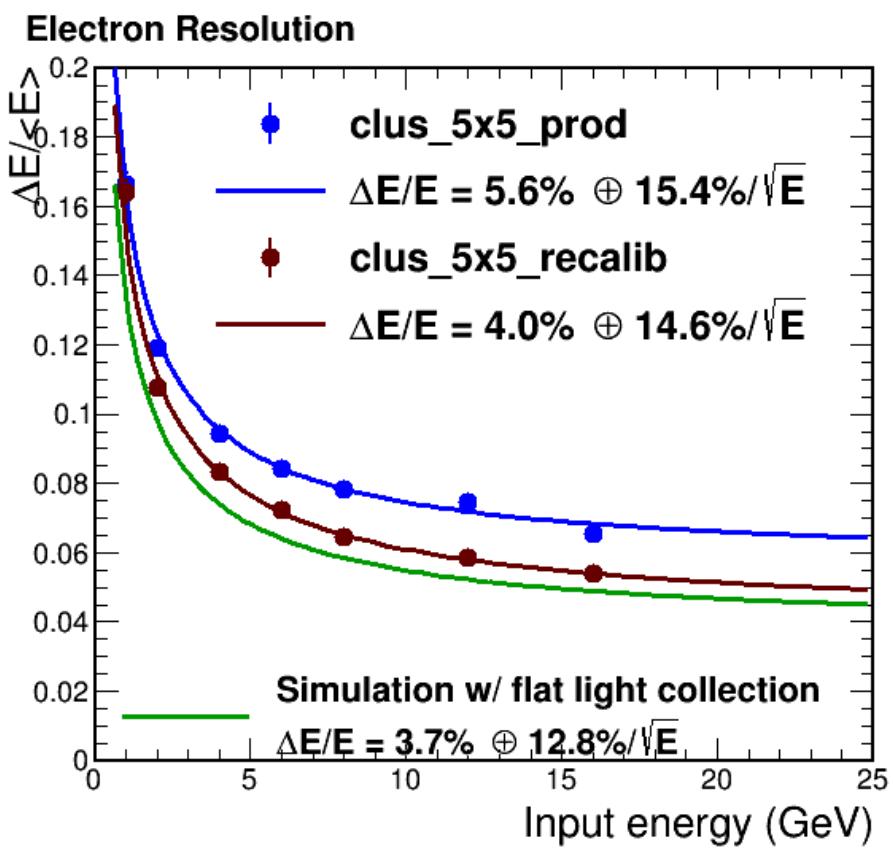
Without Hodo Recal





8x8 Hodoscope Cut (i.e. no cut) (runs 3736-3741)

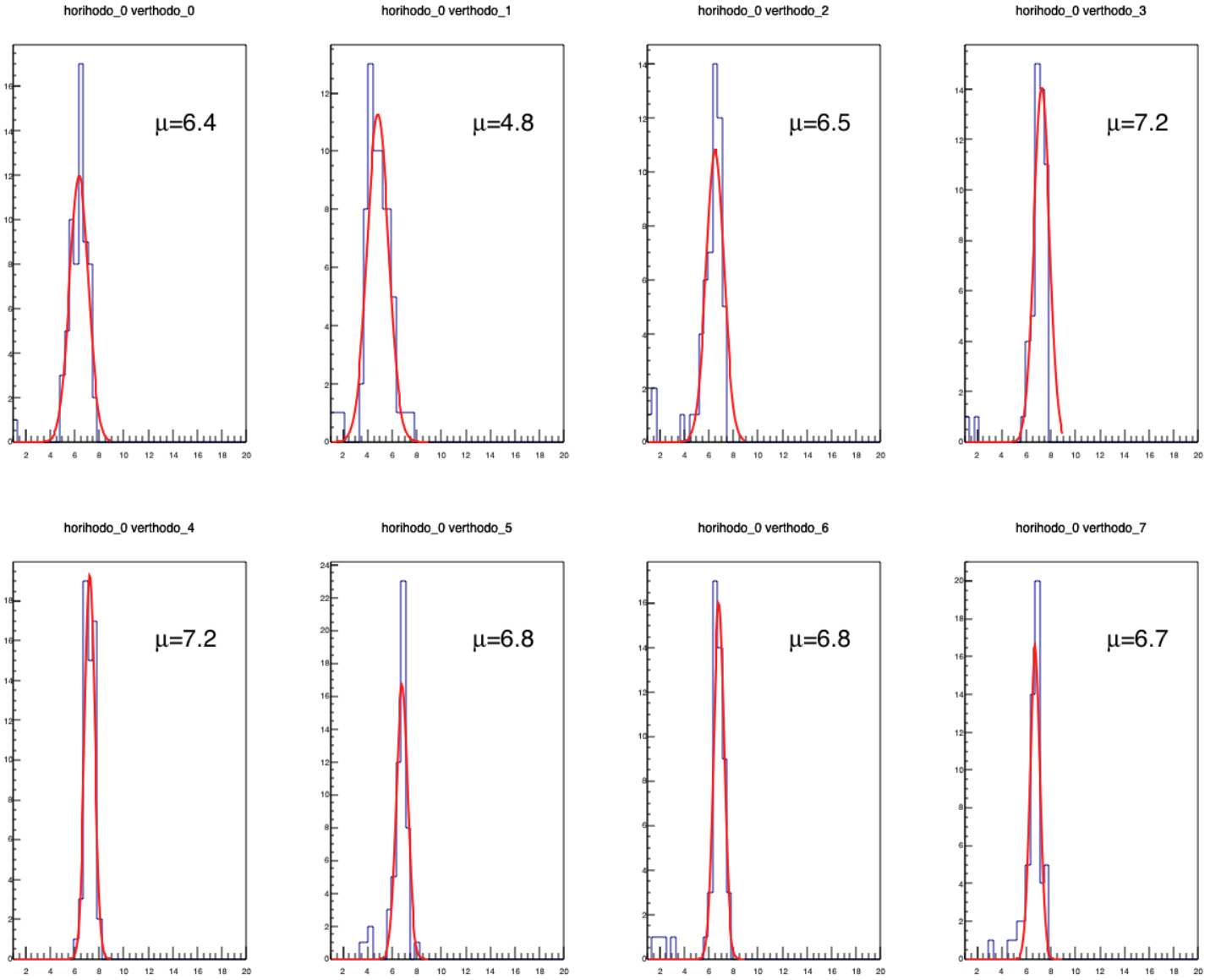




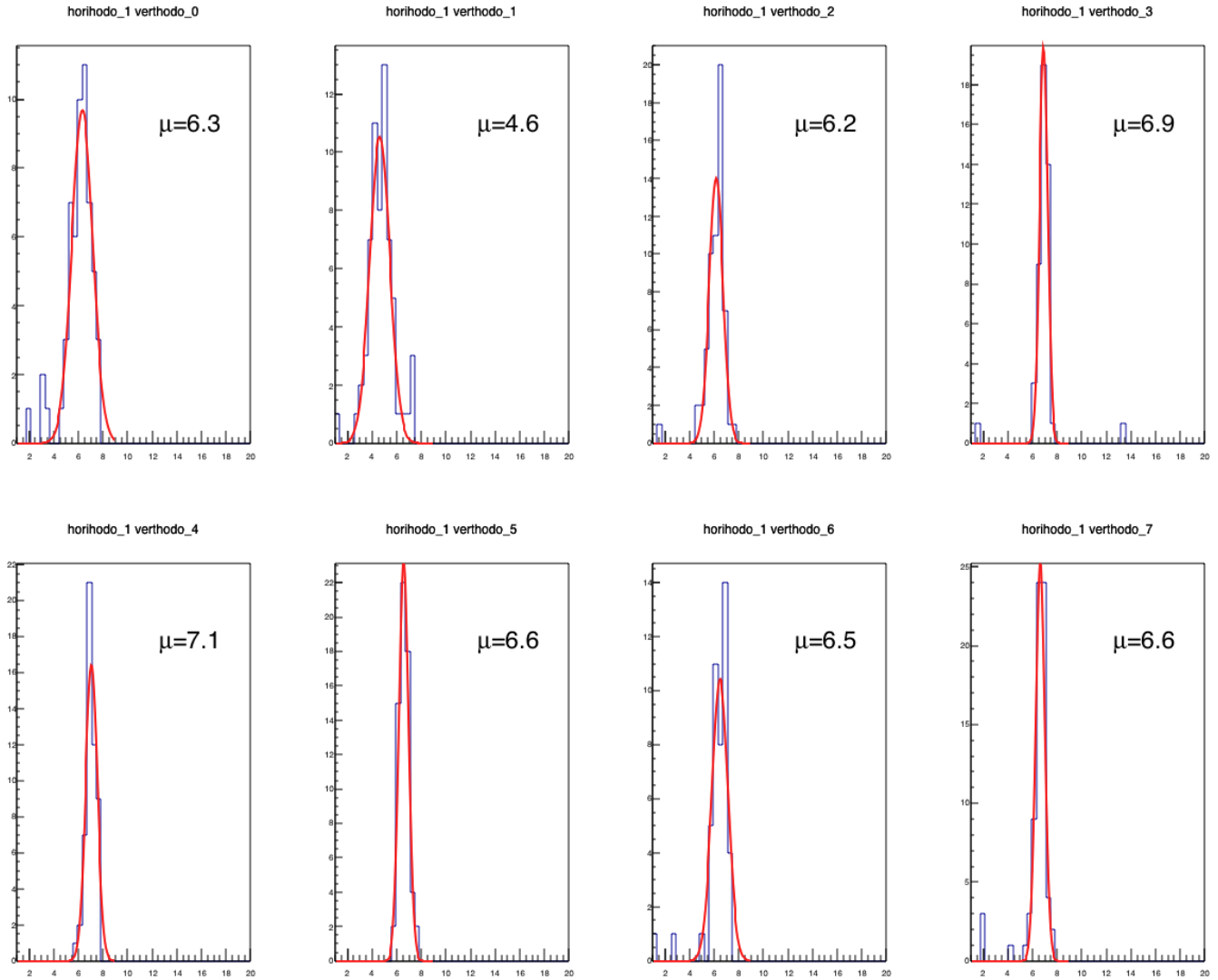
Hodo Recal (third joint energy scan)

i.e. with block boundaries

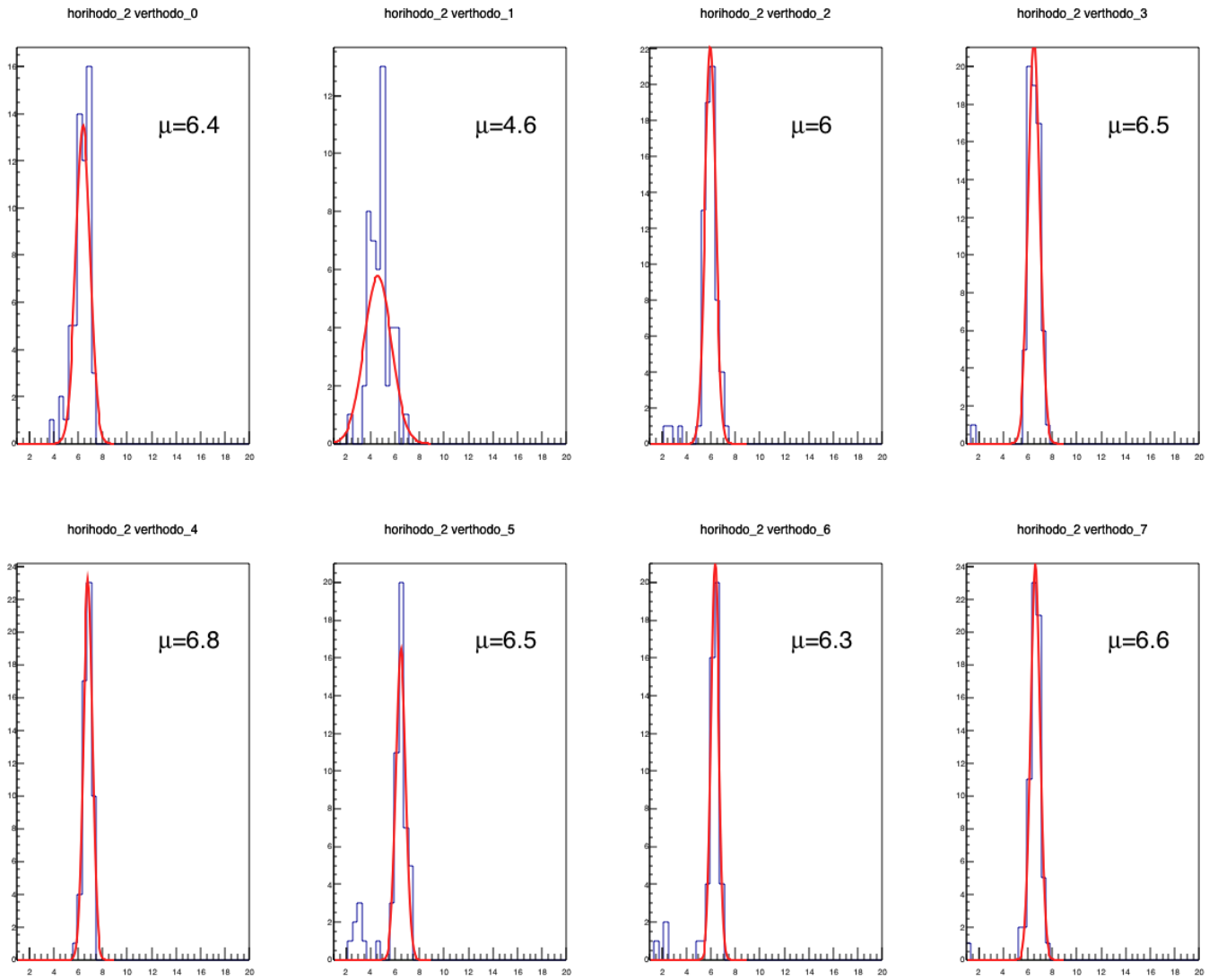
Horizontal Hodoscope 0



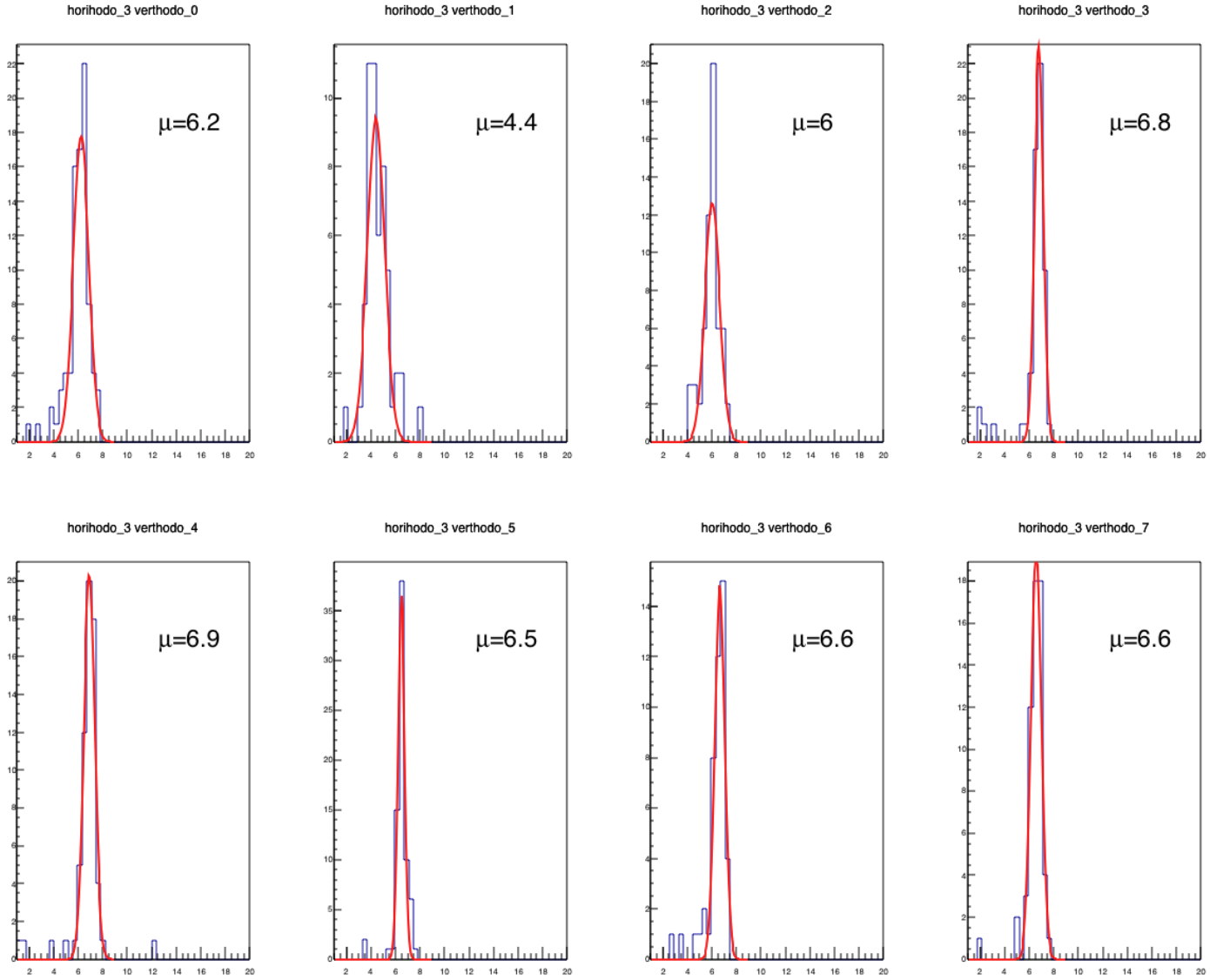
Horizontal Hodoscope 1



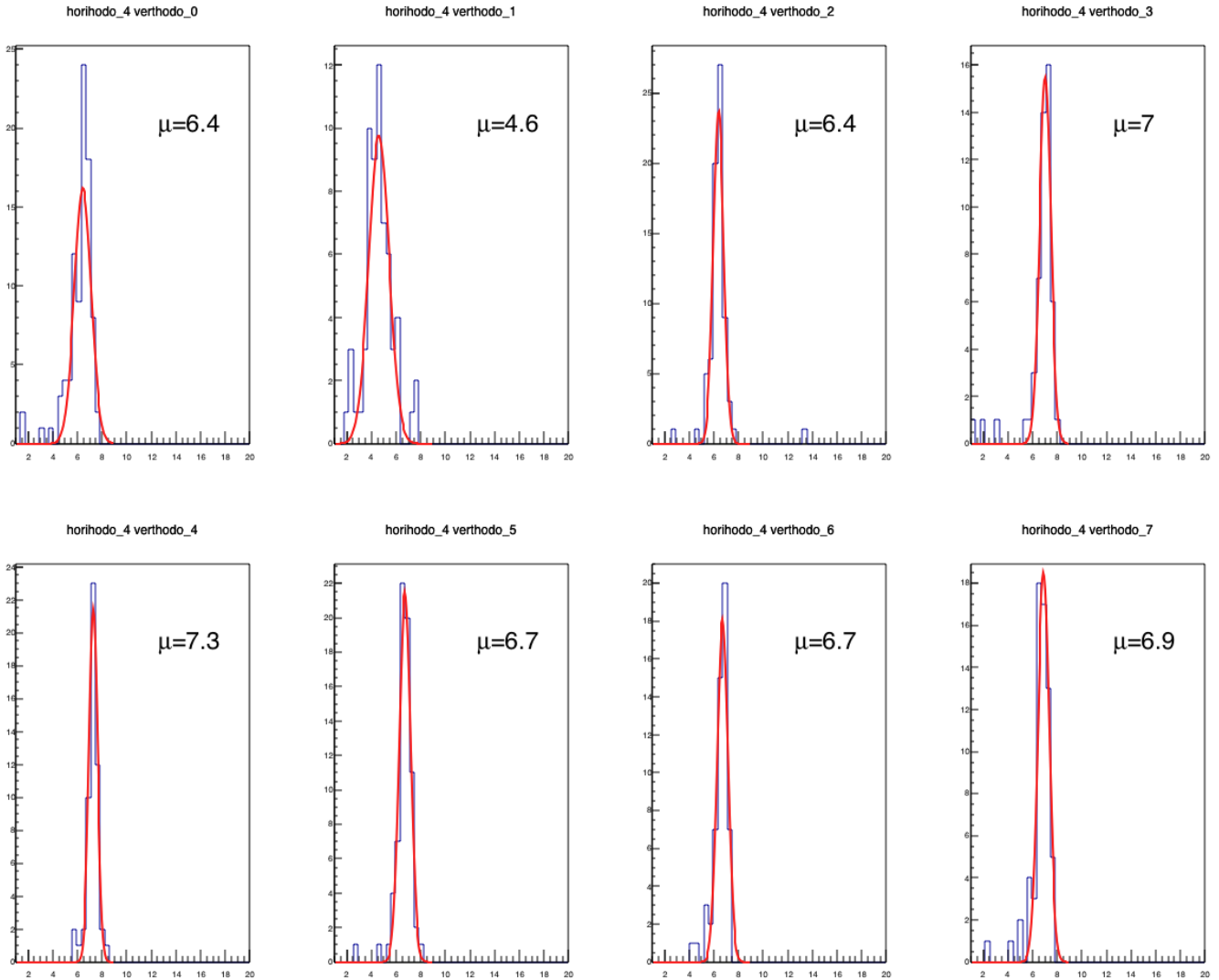
Horizontal Hodoscope 2



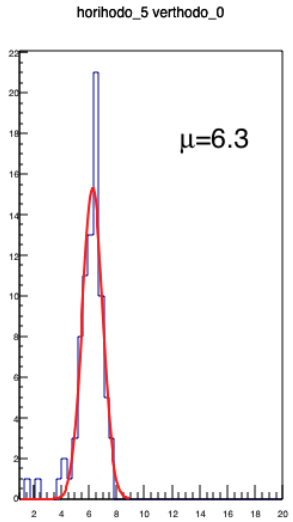
Horizontal Hodoscope 3

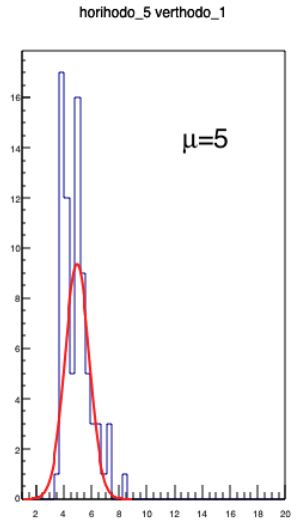


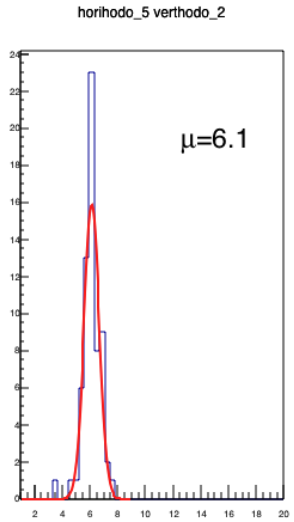
Horizontal Hodoscope 4

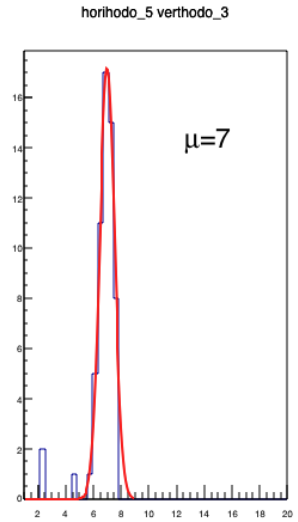


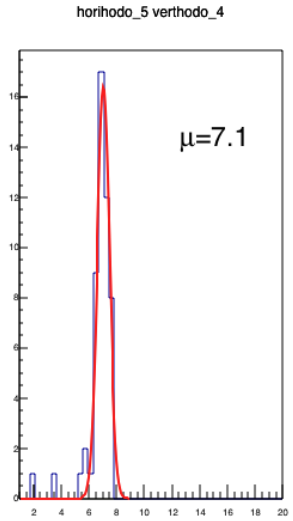
Horizontal Hodoscope 5

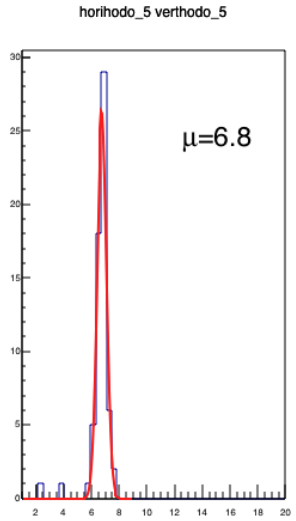


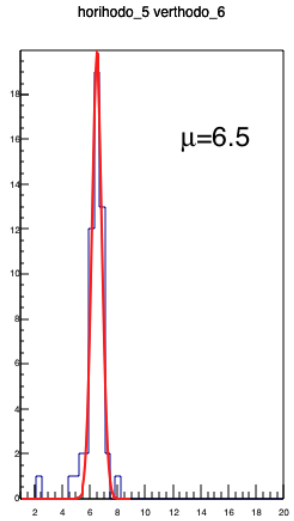


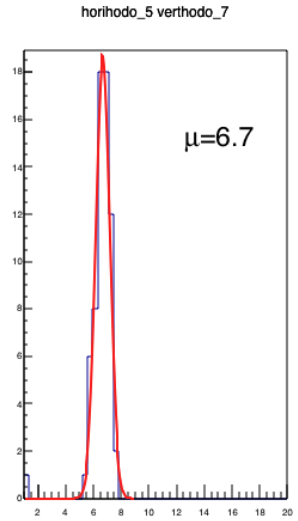




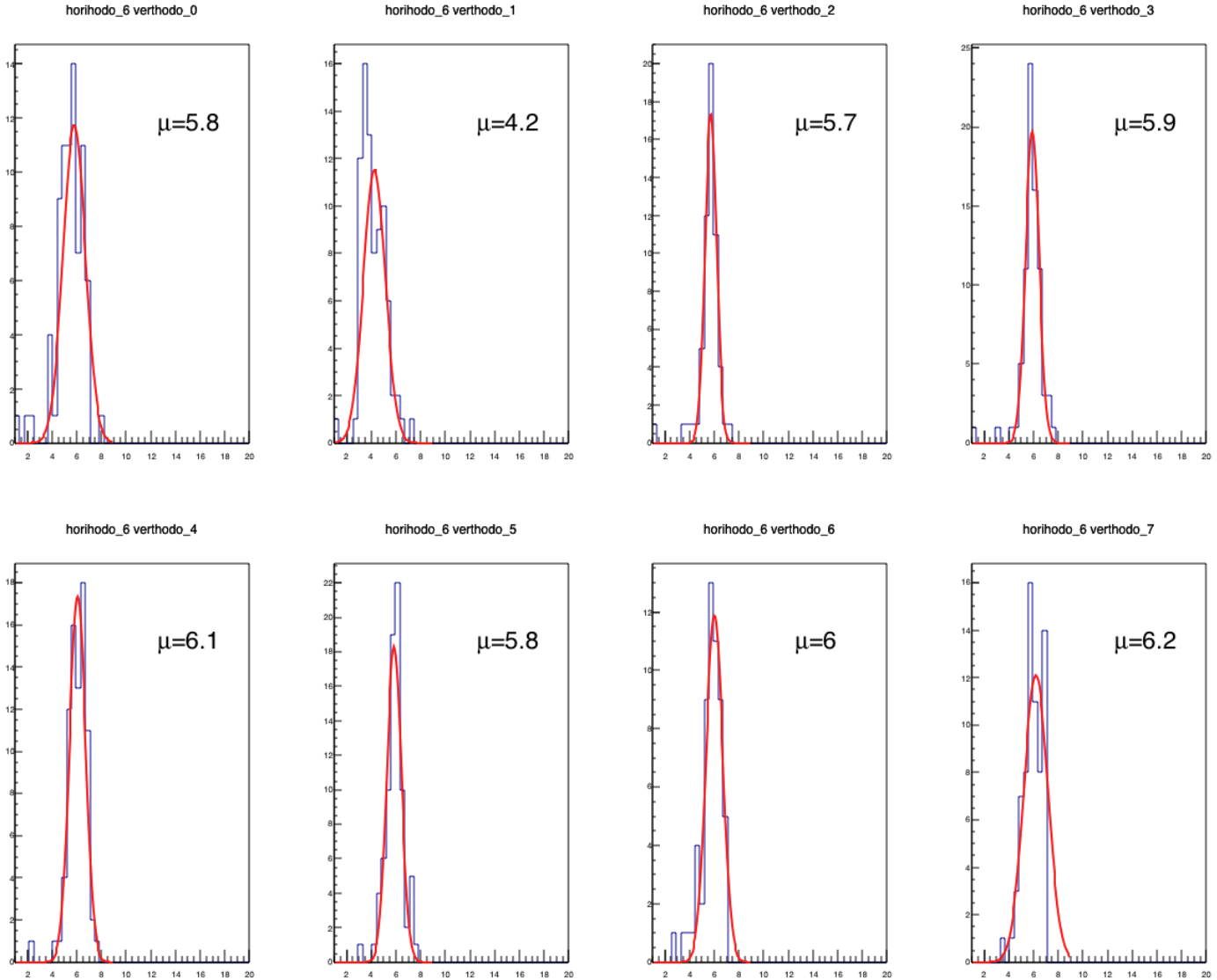




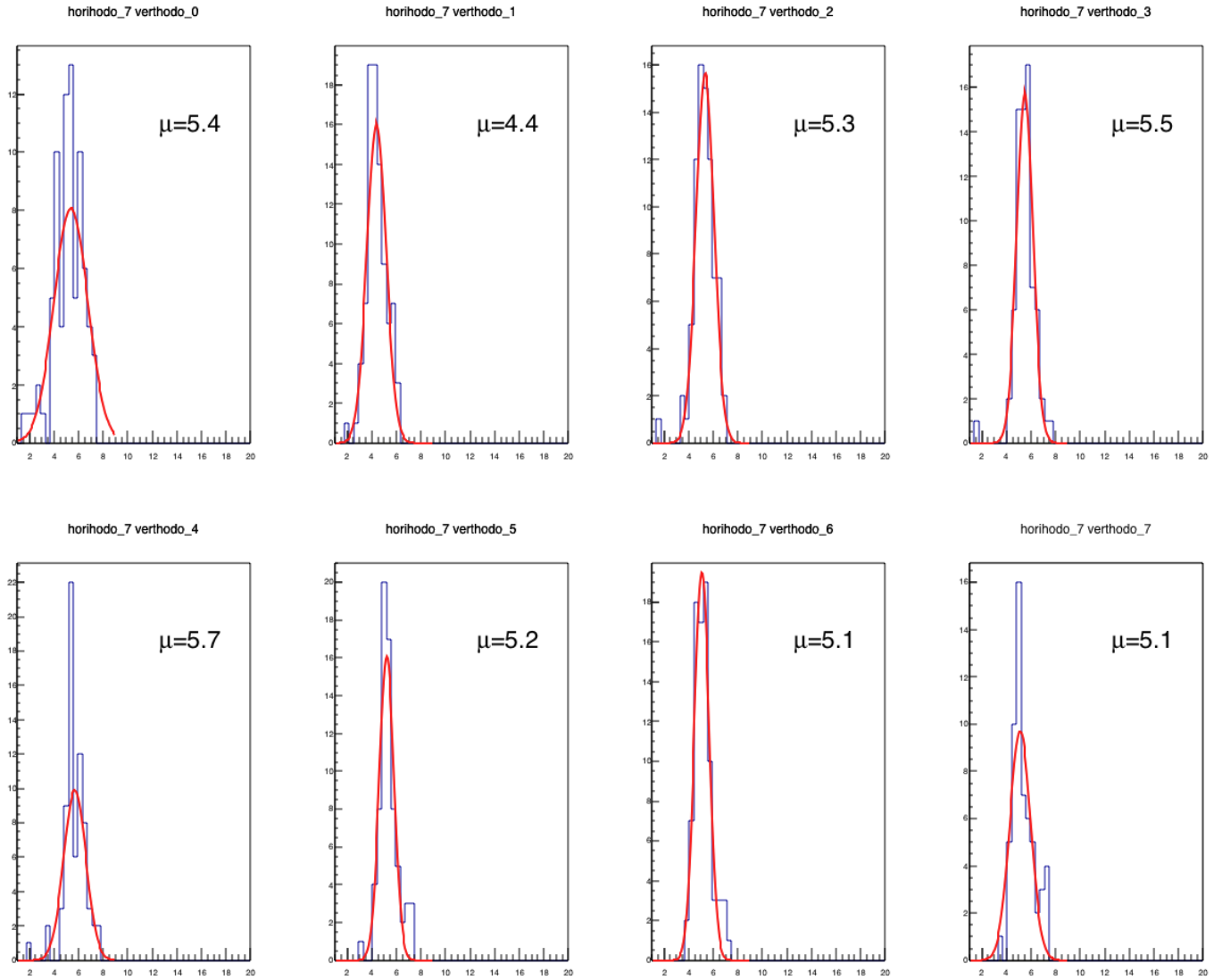




Horizontal Hodoscope 6

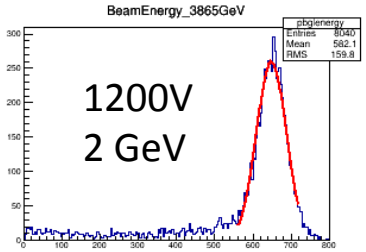


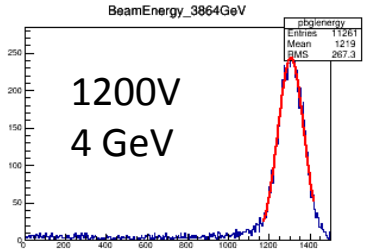
Horizontal Hodoscope 7

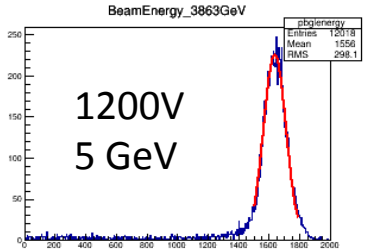


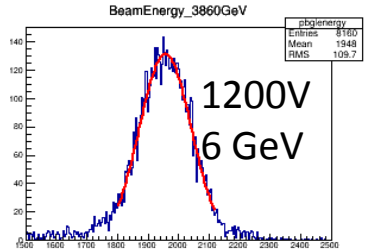
PbGl extras

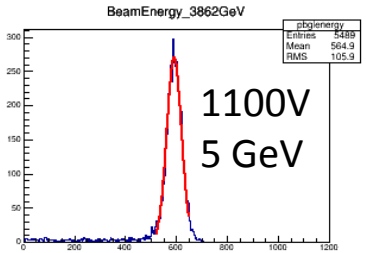
PbGl Extra Plots

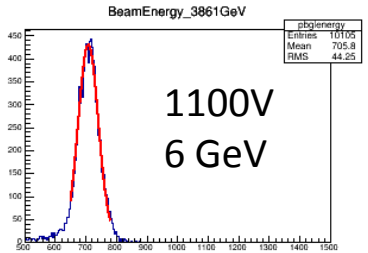


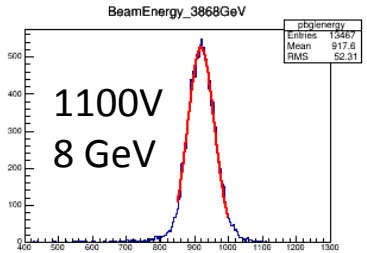


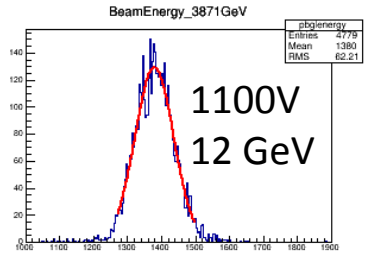


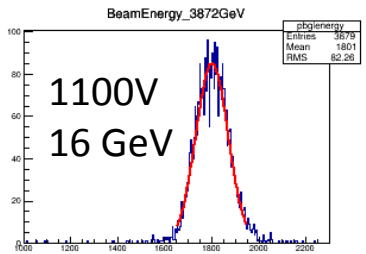


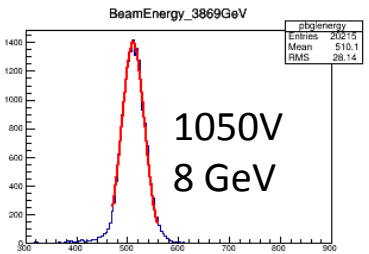


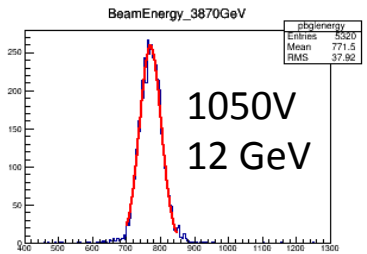


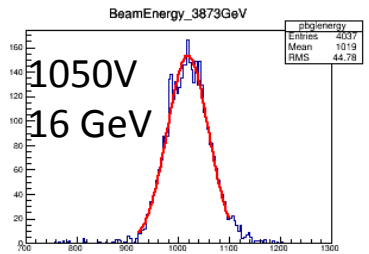


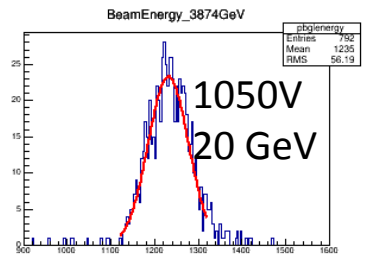






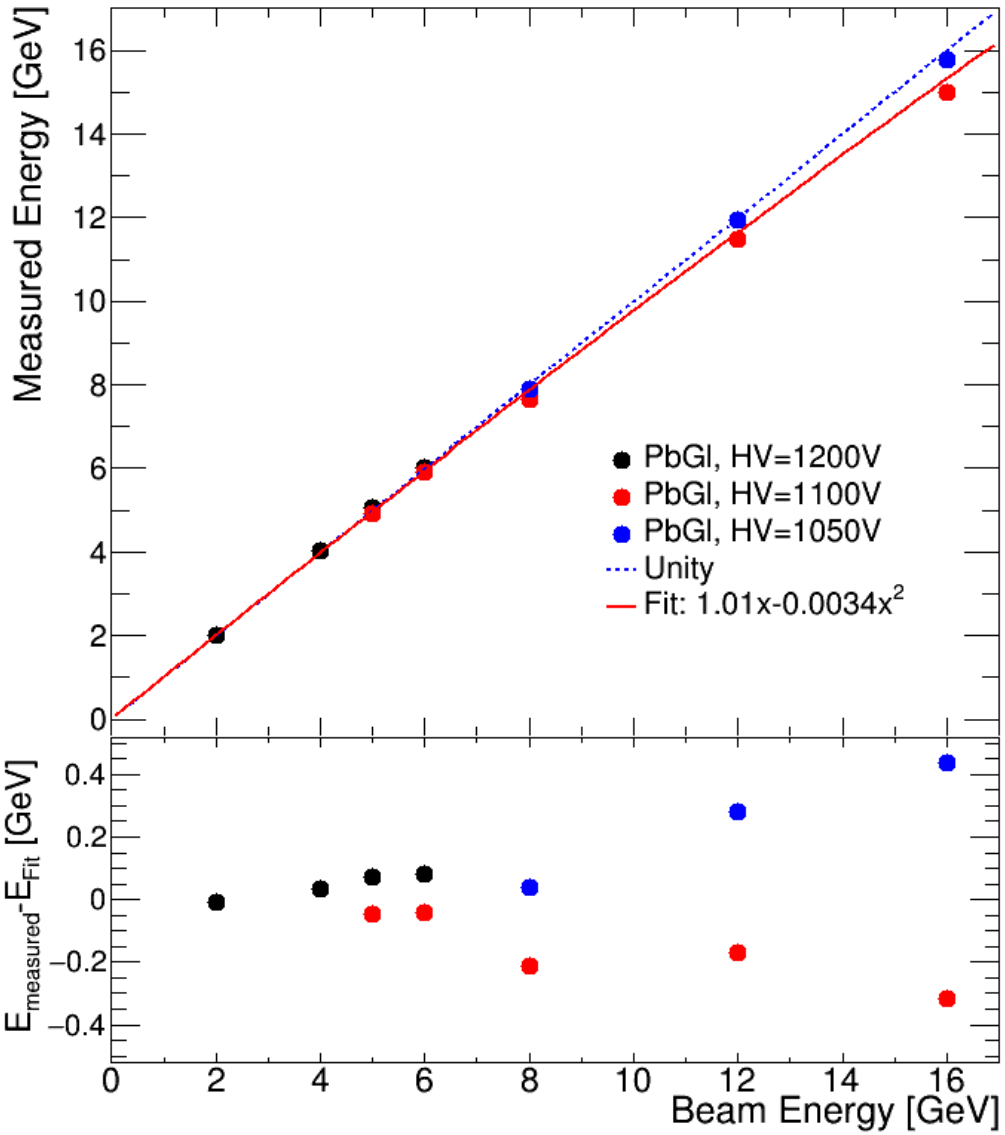


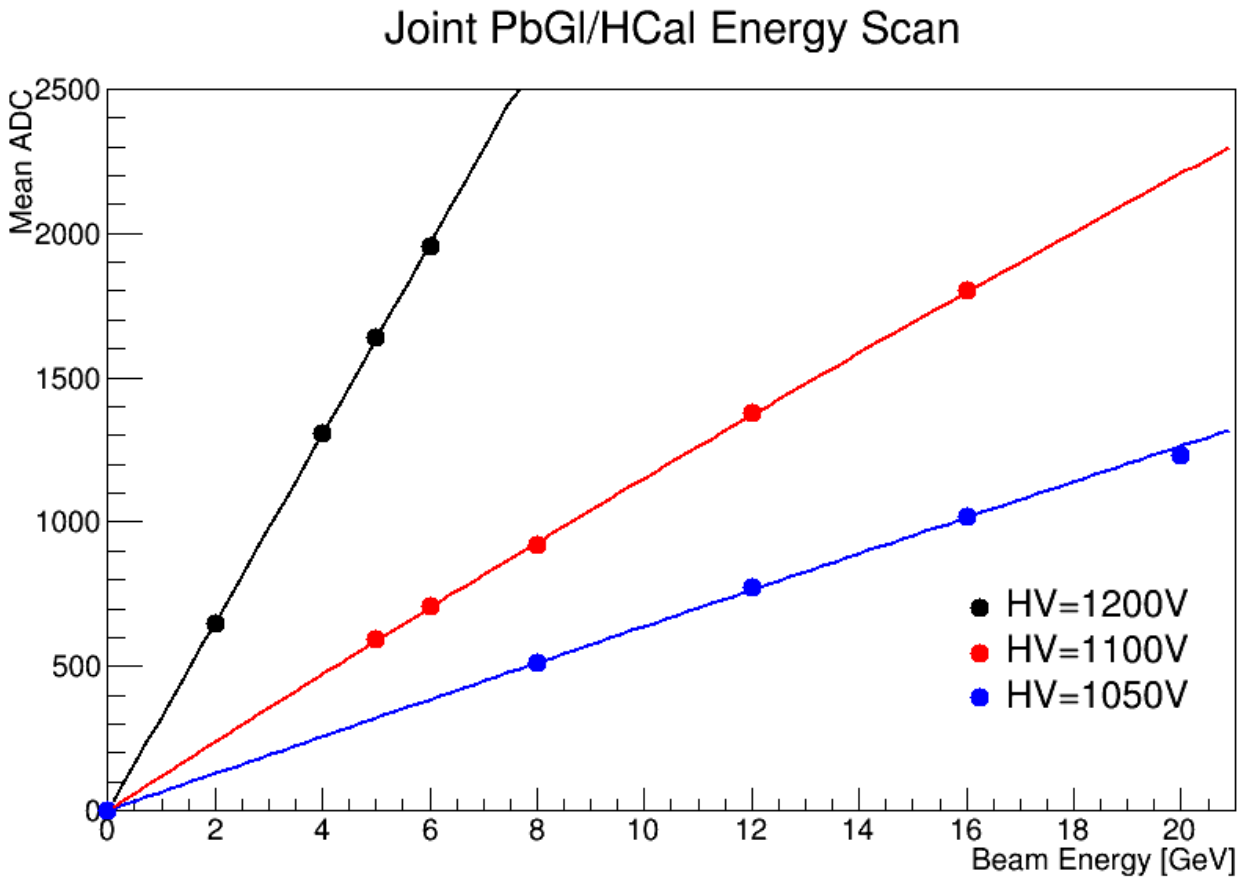




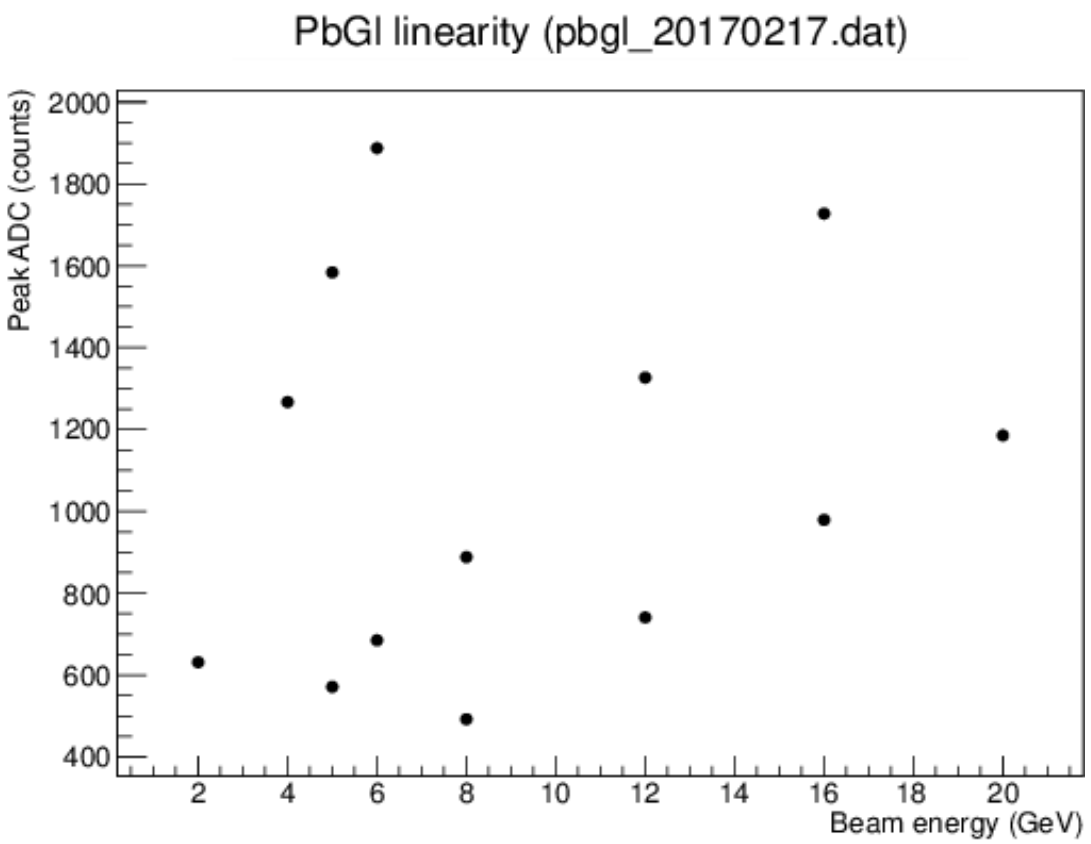
- Individual ADCs for a run with Gaussian fits
- one panel = one run = 1 beam energy

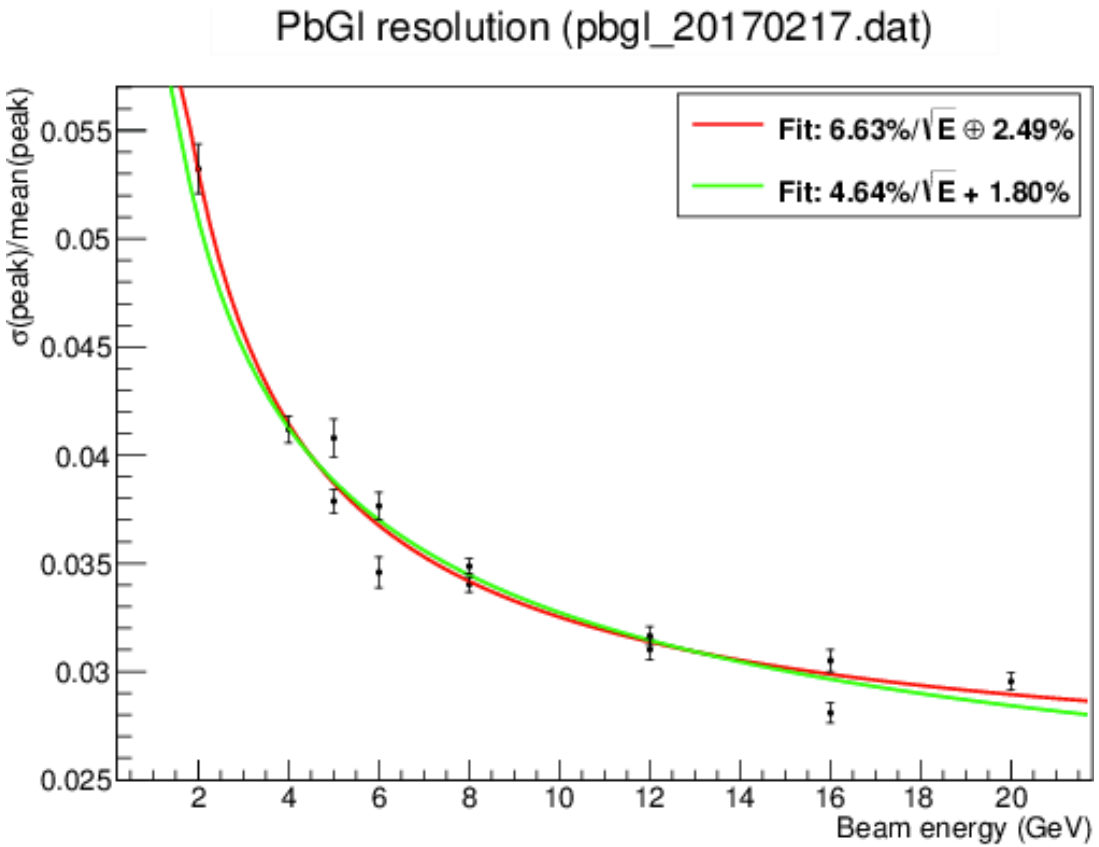
PbGl Extra Plots



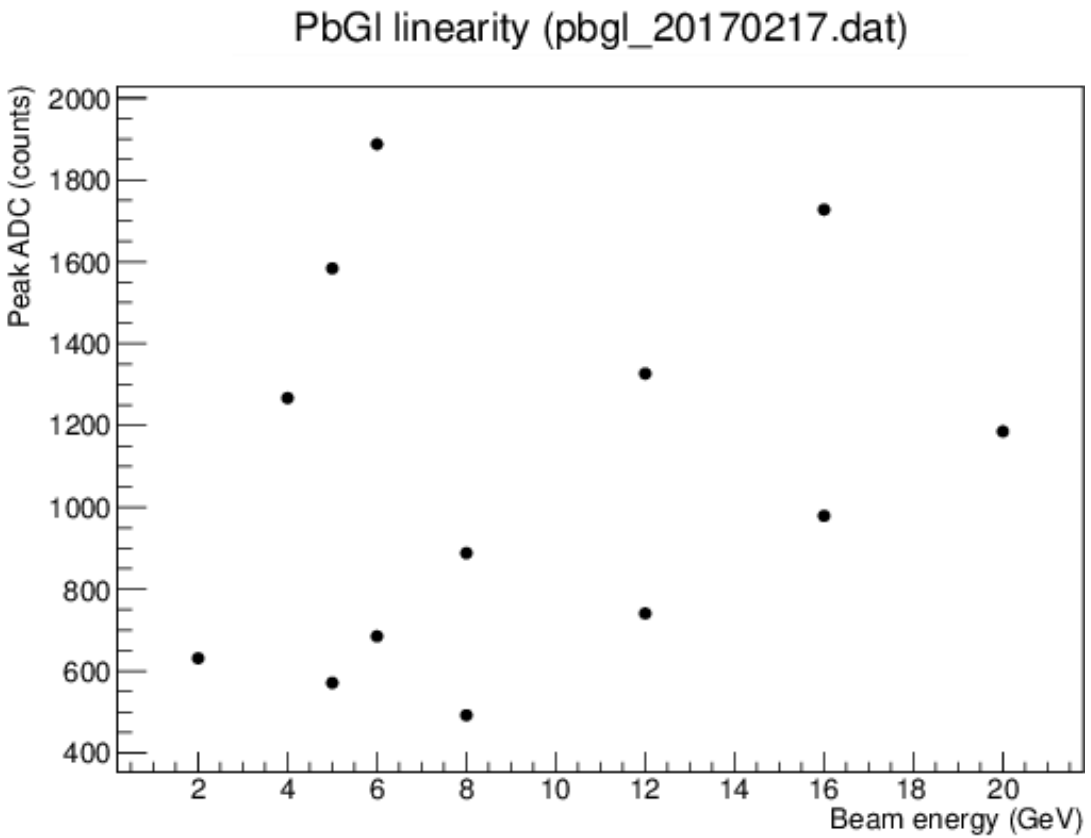


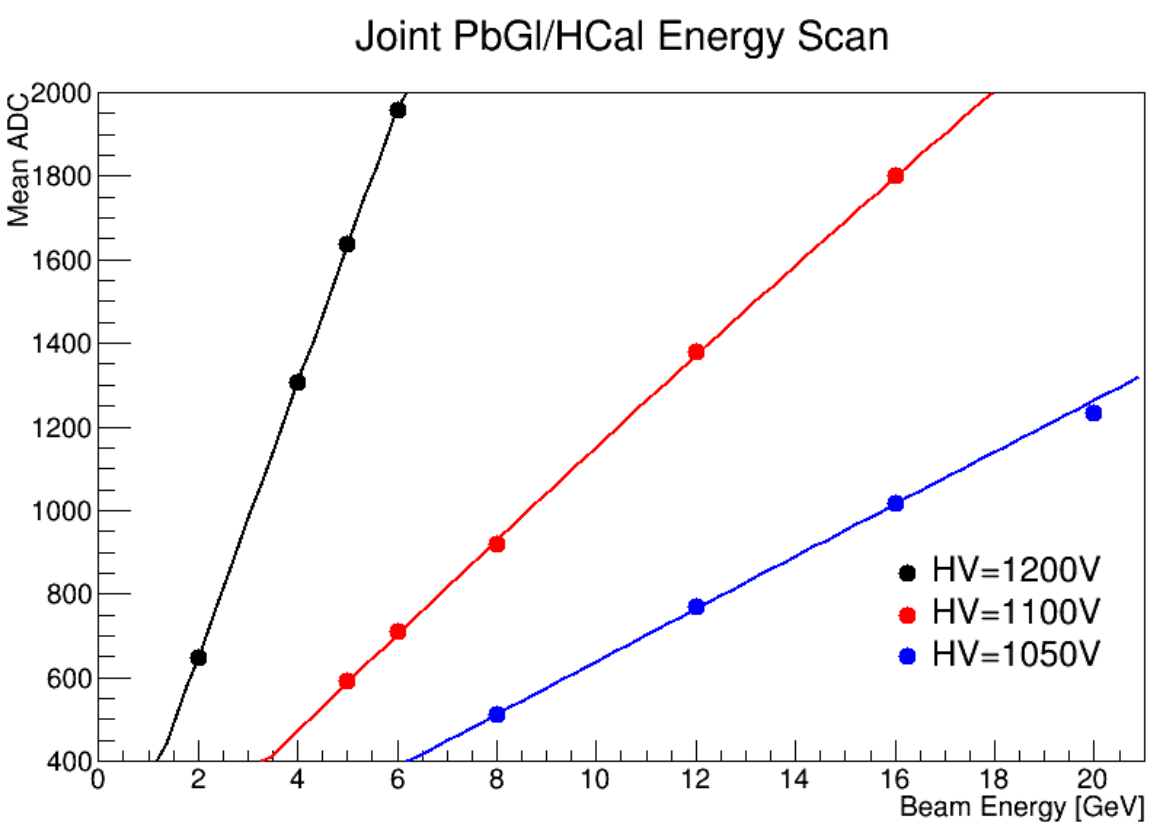
John Haggerty's Online PbGl analysis of 3860-3874





Note: I found in dedicated PbGl run that including C1 and hodoscope cuts raises constant value and reduces 1/sqrt(E) term. See wiki





My mean ADCs seem comparable if not slightly larger than John's online analysis